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STEINBERG (R. A.). **Sporangial propagation of blue mold fungus on aseptically grown Tobacco seedlings.**—*Bull. Torrey bot. Cl.*, lxxiii, 5, pp. 417–418, 1946.

In order to obtain pure cultures of *Peronospora tabacina*, the agent of tobacco blue mould, which can be propagated only on its host, one-month-old Maryland medium broadleaf and Xanthi Turkish seedlings were grown in 200 c.c. Erlenmeyer flasks on 50 c.c. mineral agar at room temperature under 500 ft. candles of intermittent or continuous light from 3,500° white fluorescent lamps [cf. *R.A.M.*, xix, p. 439]. The lower leaf surfaces were inoculated with bits of sterile filter paper pulp which had been rubbed over a spore-covered leaf. The flasks were kept at the bottom of a lighted refrigerator in a glass moist chamber at 45° to 50° F. for seven days, after which they were removed from the moist chamber and transferred to the top of the refrigerator where the temperature was about 72°. Sporangia began to appear on the upper sides of the inoculated leaves on the seventh day and production reached a climax on the twelfth. Viable sporangia were still present on infected plants after three weeks in the lighted refrigerator and a further fortnight's storage in the dark at 41°. The fungus also fructified abundantly at a uniform temperature of 59° provided by a 25-watt tungsten lamp in a refrigerator of 5 cu. ft. capacity.

By these means *P. tabacina* was maintained for over a year, through 27 successive transfers, by the third of which all extraneous contaminants had been eliminated. The symptoms of infection were similar to those seen in nature, except for a greater profusion of sporangia on the upper than on the lower leaf surfaces. Infection was not confined to the inoculated leaves. Blackening at the leaf midrib and stem bases indicated the passage of the pathogen through these tissues. Abundant fructification also occurred on leaves detached immediately before inoculation, the bases of which had been plunged into the agar, and on turgid seedlings growing on agar that had almost completely dried out.

Light appeared to be essential to sporangial formation, which did not occur in flasks wrapped in black paper during the last fortnight of the three-week period, while darkness during the vegetative phase (first week after inoculation) partially or totally inhibited it. The seedlings on which sporangia were thus suppressed remained free from blue mould. All attempts to cultivate the fungus on artificial media were unsuccessful.

CLAYTON (E. E.). **Aerosol treatments for the control of Tobacco blue-mold disease.**—Abs. in *Phytopathology*, xxxvi, 8, p. 684, 1946.

A successful adaptation of the benzyl salicylate-cottonseed oil spray for the control of tobacco blue mould [*Peronospora tabacina*: *R.A.M.*, xxii, p. 115; cf. xxv, p. 583] to the aerosol [ibid., xxv, p. 4] type of treatment has been in use for two years at a concentration of 4 oz. benzyl salicylate and 1 gal. cottonseed oil. Either cartridges were loaded with 40 per cent. of the spray and 60 per cent. 'freon', or small high-pressure sprayers were charged with 43 per cent. spray and 57 per cent. acetone, air pressure being adjusted to about 110 lb. Small plants received six

minutes' spraying per 100 sq. yds. and large plants up to 14 minutes'. Excellent control was secured.

TROTTER (A.). **Sulla presenza di tumori radicali nelle coltivazioni di Tabacco di pieno campo.** [On the presence of root tumours in Tobacco plantations in the open field.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), x, pp. 65–80, 1 pl., 7 figs., 1946.

A full description is given of root tumours with the characters of those due to *Bacterium tumefaciens* [*R.A.M.*, xvii, p. 18] observed on Kentucky tobacco growing in the field at Padula (Salerno) and Magliano Sabino (Rieti), Italy. Some of the plants were stunted, showed sparse, small, rather contorted, pale leaves, and slow, if any, flowering. Tumours were found on the roots near the collar, though eelworms were not present. These swellings were most numerous and largest (5 to 7 cm. in diameter) where the main roots branched, and less numerous and smaller on the secondary roots, especially the more distal ones. Clusters of tumours were also found. All along the thicker roots tumours, about 1 cm. in diameter, sometimes unilateral, had formed. Still smaller tumours, 4 to 5 mm. in diameter, single or aggregated, were present near the ends of the secondary roots.

In the final stage studied by the author the tumours were dark brown, soft, not woody, and the tissues were decomposing. The surface was unequal and bore small protuberances resembling rudimentary shoots. Some of these grew and formed imperfect leaf clusters, which were conspicuously vascularized and provided with thick, multiseptate hairs. Occasionally, true buds formed with normal leaflets.

At Padula Burley tobacco was also affected, though slightly. The condition was first noted on Kentucky in 1940, but had probably been present three or four years. In 1941, it was much more prevalent and severe, about 30 to 40 per cent. or more of the plants being affected, especially in the more compact soils. The two-year tobacco–wheat rotation, and perhaps also a not too careful digging of the ground, favoured further spread. Where tobacco was grown with a longer rotation, especially with lucerne, yield was much more satisfactory. Young stunted plants examined one month after transplanting, i.e., at the end of June, showed no sign of tumour formation, though *Thielaviopsis basicola* was present, but the tumours were present by the end of July, which suggests that they appear when the plants reach their maximum vegetative growth, probably during some new phase of root development. In 1942, identical symptoms appeared on an epidemic scale at Magliano Sabino in Umbria on Padano, a variety of Kentucky.

Fully developed tumours showed the presence of *T. basicola*, apparently growing as a saprophyte. The tumours are attributed to *Bact. tumefaciens* on the grounds of their characteristics, the organism not having been isolated from them. The paper concludes with recommendations on control by the use of resistant varieties, the avoidance of wounds caused by insects, etc., and good cultural practices.

NOORDAM (D.). **Over het voorkomen van 'spotted wilt' in Nederland.** [On the occurrence of 'spotted wilt' in Holland.]—*Tijdschr. PlZiekt.*, xlix, 4, pp. 117–119, 1 fig., 1943. [Received November, 1946.]

There have been various references in the Dutch phytopathological literature since 1931 to the suspected occurrence of the tomato spotted wilt virus on tomato and other plants in Holland, including van Schreven's account of the so-called 'Huissen disease' [*R.A.M.*, xv, p. 181], which K. M. Smith regards as a complex with spotted wilt as one component. In 1942 J. Guittart observed among a number of *Richardia africana* plants two with the typical symptoms of the virus, which was successfully transmitted by means of expressed sap to *Hippeastrum hybridum*, *Gloxinia hybridum*, *Nicotiana glutinosa*, *Solanum capsicastrum*, tomato, and peas [ibid., xvi, p. 134]. No extended observations on the disease or *in vitro* identifica-

tion tests have yet been carried out, but it is deemed advisable to call attention to this further corroboration of previous evidence pointing to the existence of the tomato spotted wilt virus in Holland.

DOOLITTLE (S. P.), PORTE (W. S.), & BEECHER (F. S.). **High resistance to common Tobacco mosaic in certain lines of Lycopersicon hirsutum.**—Abs. in *Phytopathology*, xxxvi, 8, p. 685, 1946.

Although the majority of plants of *Lycopersicon hirsutum*, highly tolerant to the yellow and green strains of the tobacco-mosaic virus [*R.A.M.*, xviii, p. 824], offer no symptoms on inoculation, there are varying and high concentrations of the virus in the inoculated plants. In 1941, however, two symptomless plants, after inoculation with the yellow strain, were found to be free from virus when tested by inoculation on *Nicotiana glutinosa* and all attempts to infect these plants failed. Repeated inoculations of 38 young and vigorous cuttings of one clonal line from one of these plants during the past four years have failed to induce infection. In the second clonal line, five out of 42 cuttings showed a trace of virus after inoculation, but the remaining plants were uninfected. Trials with the seed progeny of these lines have been restricted by the difficulty of securing seed of *L. hirsutum*, but 21 of 58 inoculated seedlings showed no infection. Crosses between these lines and commercial tomato varieties have yielded tolerant individuals, but none have exhibited the high resistance of the wild parents.

VAN KOOT (Y.) & PATTJE (D. J.). **Vergeling van Tomatenplanten tengevolge van magnesiumgebrek.** [Chlorosis of Tomato plants in consequence of magnesium deficiency.]—*Tijdschr. PlZiekt.*, xlviii, 5, pp. 121–137, 2 pl., 1942. [English summary. Received November, 1946.]

Tomato plants in Westland, Holland, suffer from two forms of chlorosis, namely, (1) in which the entire leaf blade turns yellow except for the tissue bordering the main veins, and (2) a much finer mottling, leaving all the veins green, even the smallest. The former type is due to magnesium deficiency [*R.A.M.*, xxiv, p. 389; xxv, pp. 15, 291] and the latter to a shortage of available manganese [ibid., xx, p. 282; xxi, p. 310] and a high pH.

Leaves affected by the magnesium-deficiency form of chlorosis swell and become brittle owing to the accumulation of starch within them, a similar feature having also been observed in neighbouring *Solanum nigrum* plants. The symptoms being suggestive of a virus disease, transmission experiments were carried out by several methods with negative results. Plants in gravel cultures deprived of magnesium developed the typical chlorosis described under (1) above.

BAKKER (MARTHA). **Resistentie tegen de bladvlekkenziekte van de Tomaat, in de practijk 'meeldauw' genoemd.** [Resistance to the Tomato leaf spot disease known in practice as 'mildew'.]—*Meded. Direct. Tuinb., 1946*, March, pp. 167–169, 1946.

At the Sappermeer Experiment Station, Holland, the Vetomold tomato variety, which is reputedly immune from leaf mould (*Cladosporium fulvum*), is now and then attacked by the disease [*R.A.M.*, xxv, p. 528], and a highly resistant local selection, the so-called 'meeldauwvrije' [mildew-free], has also shown traces of infection under very adverse conditions. Physiologic specialization within the pathogen may perhaps explain this occasional failure of resistance.

FENNELL (J. L.). **A new Tomato for the tropics.**—*Agric. Amer.*, v, 12, pp. 233–235, 2 figs., 1945.

An account is given of the development at the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, of the Turrialba tomato variety, a

cross between the wild berry tomato, *Lycopersicon esculentum* var. *cerasiforme*, and Cuban Marglobe. The new variety, which is to be perfected as rapidly as possible for general distribution, is characterized by high resistance to *Alternaria solani*.

Heuberger (J. W.). **Tomato anthracnose control.**—*Canning Tr.*, lxviii, 38, p. 22, 1946.

Independent investigations in Delaware and Ohio in 1944 revealed the superiority of zerlate (zinc dimethyl dithiocarbamate) [*R.A.M.*, xxv, p. 415] to an alternating schedule of fermate and fixed copper for the joint control of tomato anthracnose (*Colletotrichum phomoides*) [ibid., xxiv, p. 294] and early blight [*Alternaria solani*]. The former disease frequently leads to the rejection of the fruit on account of high mould count [ibid., xxv, p. 426] and is in consequence much dreaded by canners. In comparative experiments in Delaware during 1944 and 1945, when five spray applications were given, beginning 30 days after the first flower-cluster had bloomed and continuing at ten-day intervals, zerlate gave the best control of anthracnose, combated early blight as well as Bordeaux, and produced the maximum yield increases. In 1944 the percentage of infection by *C. phomoides* was reduced from 21·4 in the untreated plots to 4·2 in those sprayed with zerlate, the corresponding figures for Bordeaux (6–3–100), compound A (3–3–100), the alternating schedule of fermate 2–100 for the first, third, and fifth applications and tribasic copper sulphate for the second and fourth, fermate 2–100, and dithane [disodium dimethyl dithiocarbamate]-zinc sulphate-lime (1½–1½–100) being 7·8, 8·7, 10·2, 8·6, and 17·7, respectively. In 1945 the percentage of anthracnose in the unsprayed plots was 35·1 and in those treated with Bordeaux compound A, the alternating schedule, fermate, zerlate, and dithane-zinc sulphate-lime 12·3, 16·1, 12·3, 13·6, 4·6, and 17·8, respectively. The zerlate-treated plots yielded 9·5 tons fruit per acre in 1945, compared with 7·7 for the controls and 8·7 to 8·9 for the other sprays.

Zerlate is ineffectual against late blight [*Phytophthora infestans*], which is, however, a rarity in Delaware. In areas where it is a limiting factor, an alternating schedule of zerlate and a fixed copper should be used.

Spaulding (P.) & Bratton (A. W.). **Decay following glaze storm damage in woodlands of Central New York.**—*J. For.*, xliv, 7, pp. 515–519, 3 figs., 1946.

Northern hardwood stands in Otsego and Herkimer Counties, New York, were severely damaged by an ice storm in December, 1942. Early in 1945 sap rot had developed at the bases of beeches and sugar maples [*Acer saccharum*], the fungi responsible for the condition having apparently gained ingress through sun-scald injuries coinciding with the sudden opening of the stands. The organisms included *Daedalea unicolor* [*R.A.M.*, xix, p. 244], which was fruiting on nearly every affected tree and evidently one of the first and most destructive invaders, *Peniophora* sp., *Polyporus adustus*, *P. hirsutus*, *P. pergamenus*, *P. tulipiferus*, *P.* [*Polystictus*] *versicolor*, and *Schizophyllum commune*, the last-named being second in abundance to *D. unicolor* but causing only slight decay.

Diller (J. D.), Whittaker (C. W.), & Anderson (M. S.). **Effect of mineral nutrition on the vigor and susceptibility to blight of old Japanese Chestnut trees.**—*Phytopathology*, xxxvi, 7, pp. 554–556, 1946.

An experiment was carried out to determine the effect of certain plant nutrient treatments on the incidence of blight (*Endothia parasitica*) [*R.A.M.*, xxiii, pp. 320, 367] in some surviving Japanese chestnuts (*Castanea crenata*) from a planting of 2,000 trees made 50 years ago near Fairfax Station, Virginia. Of the 64 trees selected for the investigation, 26 were inoculated during the winter of 1944–5 on nine lower branches of each tree with nine isolates of the pathogen from Massachusetts and nine from Maryland. The soil amendments consisted of phosphorus

and potash, applied on 2nd March, 1944, in 'punch holes' 2 ft. apart, at 100 and 75 lb. per acre, respectively, with or without nitrogen, broadcast at 150 or 300 lb. per acre, the last-named constituent, at both rates, also being repeated on some of the trees on 2nd March, 1945.

Neither the minerals nor nitrogen at the lower dosage significantly affected shoot growth, which was, however, materially increased by the first nitrogen treatment of 300 lb. (from an average total shoot length per tree of 175·6 to 223·1 cm.); the second-year application did not produce comparable effects. As regards canker incidence, the statistical data are more difficult to interpret and require further study, but it is evident that the mineral fertilizers enhanced susceptibility to the pathogen, an effect that was modified, however, in a complex manner by their combination with nitrogen. The pathogenicity of the longer-established group of Massachusetts isolates did not appear to have decreased in comparison with those from Maryland, which were made over ten years later.

KIMMEY (J. W.). **Notes on visual differentiation of White Pine blister rust from Pinyon rust in the telial stage.**—*Plant Dis. Reptr*, xxx, 2, pp. 59–61, 1946. [Mimeographed.]

For the purpose of distinguishing between *Cronartium ribicola* and *C. occidentale* [*R.A.M.*, xxiv, p. 127] in the field the author finds that the following five visually recognizable differences between the two rusts are useful. Teleutosori columns forming furry mats were common on leaves bearing *C. occidentale* but never found on those bearing *C. ribicola*. Columns of mature, ungerminated teleutosori of *C. occidentale* are generally a darker brown than those of *C. ribicola*, which are often orange. After germination of the teleutosori, the faded columns of *C. occidentale* usually present a lavender tinge, while those of *C. ribicola* do not. The failure of infected leaf areas to produce teleutosori after uredosori and the absence of the latter round infection spots were common features of *C. ribicola* but rare in *C. occidentale*; consequently a specimen with a considerable area of infection without columns of teleutosori is likely to be *C. ribicola*. In slight infections the pattern for *C. ribicola* takes the form of small spots scattered over the leaf surface, whereas with *C. occidentale* larger patches or continuous areas are present.

POMERLEAU (R.). **Relation entre le développement des caries du Sapin et le site.** [Relation between the development of Fir rots and the site.]—Abs. in *Ann. Ass. can.-franç. Sci.*, xii, pp. 79–80, 1946.

Previous studies in Canada and the United States have shown that the development of fir [*Abies*] rots is directly related to the age of the trees, and also that the percentage of the volume of decayed wood rises more rapidly among trees on a poor than on a fertile site. A comparative analysis of the results obtained in Quebec, New England, and the Great Lake States shows that, for a given age, the percentage of the volume and number of rotted trees is substantially lower in the boreal conifer forests than in those of the deciduous tree zone. Furthermore, the velocity of stem disorganization and of the brown butt rots increases *pari passu* with distance from the boreal zone. Using Heimburger's modified method, significant differences in the extent of fir rots were revealed in regard to each of the five recognized site types.

RICHENS (R. H.). **Forest tree breeding and genetics.**—Imperial Bureau of Plant Breeding and Genetics and Imperial Forestry Bureau, Joint Publication No. 8, 79 pp., 1945. [English, German, French, and Spanish summaries.]

This comprehensive study of forest tree-breeding and genetics, with a bibliography of over 14 pages, aims at presenting a synthesis of what appears most

important in the extensive literature, especially foreign, on this subject which has appeared since 1930.

Two introductory sections (15 pp.) present the general principles underlying tree-breeding and survey the criteria used by breeders in selecting new lines. Among these criteria is included resistance to bacteria, viruses, and fungi, but the first two are considered hardly to have come within the scope of breeders as yet. Breeding of varieties resistant to fungal diseases, however, offers a more promising and less costly method of combating the many serious pathogens of forest trees than large-scale control.

In sections III (Gymnosperms) and IV (Angiosperms) the available information on the selective criteria, discussed in the previous section, is summarized under the tree genera arranged alphabetically.

STARKER (T. J.). **Preservative treatment of fence posts : 1945 progress report on the Post Farm.**—*Bull. Ser. Ore. Engng Exp. Sta.* 9G, 16 pp., 1 fig., 1 graph, 1946.

At the eighth annual examination of the Post Farm at the Oregon State College on 20th December, 1945, 36 posts were removed on account of failure, compared with 29 in 1944 [*R.A.M.*, xxv, p. 242]. In an appendix directions are given for the application of a simple and inexpensive preservative treatment, consisting of equal parts of mercuric chloride, arsenic, and sodium chloride, of which a tablespoonful suffices for each 4-in. post. A life of 15 years has been obtained for Douglas fir [*Pseudotsuga taxifolia*] posts treated with this formula.

Timber preservation.—45 pp., 8 pl., London, Timber Development Association Limited, 1946.

This useful booklet presents the essential information on up-to-date methods of timber preservation, including a list of preservatives of three types, viz., tar-oil, water solution, and organic solvent, a table exemplifying their applicability for different purposes, directions for the preparation of the wood for treatment, methods of application, advice on the prevention of sap stain and the preservation of mining timber, observations on the factors affecting preservative penetration, and an account of the properties and uses of treated timber. Appendix I deals with the permeability of timber to preservatives and II lists some proprietary preparations.

SMITH (K. M.) & MARKHAM (R.). **An insect vector of the Turnip yellow mosaic virus.**—*Nature, Lond.*, clviii, 4012, p. 417, 1946.

In an experiment on the insect transmission of turnip yellow mosaic virus [*R.A.M.*, xxv, p. 284] two insect-proof cubicles in a greenhouse were filled with healthy young turnip and Chinese cabbage and two infected plants were placed in each. In one cubicle a large number of flea-beetles, mostly *Phyllotreta cruciferae* and *P. vittula*, were released, while the other was kept free from insects. Ten days later the first plant became infected, the next day three more, and in the next two days five more. In the control cubicle the virus did not spread. If this result is confirmed, it will be the first example in Great Britain of virus transmission by a biting insect.

MITCHELL (K. J.). **Preliminary note on the use of ammonium molybdate to control whiptail in Cauliflower and Broccoli crops.**—*N.Z. J. Sci. Tech.*, A, xxvii, 4, pp. 287–293, 2 figs., 1945.

'Whiptail' appeared in cauliflower and broccoli crops in North Island, New Zealand, in 1943, causing up to 50 per cent. distortion of growth and a heavy drop in the production of marketable curds. Preliminary experiments indicate that control may be effected by dressings of ammonium molybdate at 20 lb. or less per

acre, while a heavy application (1 ton per acre) of blood and bone manure reduced the incidence of the disorder by 60 per cent. Carbonate of lime (4 tons per acre), applied just before planting out, conferred no apparent benefit, but when 3 cwt. muriate of potash was used in addition there was a considerable, but not significant, reduction in the number of diseased plants [cf. *R.A.M.*, xxiii, p. 55].

MATTHEWS (R. E. F.). **Sugar Beet mosaic in New Zealand.**—*N.Z. J. Sci. Tech.*, A, xxvii, 4, pp. 294–302, 7 figs., 1945.

Spontaneous infection by the beet mosaic virus was found on sugar beet and mangels in the Bunnythorpe and Palmerston North districts of New Zealand late in 1940, this being the first record of the disease for the country. The identity of the virus from the diseased plants with the beet mosaic virus was established by comparative symptomatological, transmission, host range, and physical property studies. Inoculation experiments on silver, sugar, and red beets and spinach were successful. Aphids (*Myzus persicae* and *Macrosiphum solanifolii*) are probably the most active agents in the spread of infection in the field, while the virus may also be perpetuated in the biennial silver beet and perpetual spinach crops, as well as in those of seed beet.

COPP (L. G. L.). **Sugar-Beet variety trials.**—*N.Z. J. Sci. Tech.*, A, xxvii, 5, pp. 376–380, 1946.

The results of four years' sugar beet variety trials demonstrated the superiority of Klein E and similar German lines to those of American origin. The latter have been specially selected for resistance to leaf spot (*Cercospora beticola*) and [mosaic] virus infection [see preceding abstract], neither of which is of major importance in New Zealand; hence the indifferent performance of the American varieties in the present series of experiments is readily intelligible. In the United States, under conditions favouring the pathogens in question, the yield relations are reversed.

WATSON (MARION A.), WATSON (D. J.), & HULL (R.). **Factors affecting the loss of yield of Sugar Beet caused by Beet yellows virus. I. Rate and date of infection; date of sowing and harvesting.**—*J. agric. Sci.*, xxxvi, 3, pp. 151–166, 8 graphs, 1946.

The average yield of sugar beet in Great Britain for 1937, 1938, 1943, and 1944, years of severe outbreaks of beet yellows virus disease [*R.A.M.*, xxv, p. 532] was 8 tons per acre; for other years since 1933 it was 9·6 tons. In 1943, the yield for a part of Lincolnshire where the disease was severe was reduced to 9·4 tons per acre, compared with an average of 11·7, while in other parts of the country, where the disease did not occur, yields above the average were recorded.

In Part I are described experiments carried out in 1941, 1942, 1944, and 1945 to measure the effect on yield and composition of sugar beet caused by artificial infection [ibid., xxii, p. 124] and its relation to the following factors: rate and date of infection, dates of sowing and harvesting, nutrition, and variety. This paper records results for the first four factors which are examined statistically in Part II. The varieties used were Kleinwanzleben E, Cannells 937, and Marsters.

It was not possible to prevent the natural spread of the virus within experimentally infected plots or the introduction of infection from outside sources. As a result, the percentage infection was higher than that expected from the experimental treatments. The observed yields were therefore corrected for accidental infections by means of regression co-efficients.

It then appeared that the reduction in yield of sugar was proportional to the rate of infection, that is, the loss of sugar was proportional to the percentage of diseased plants, a result which may prove useful in forecasting yields prior to harvest. No compensation for this loss was observed by increased growth in adjacent healthy

plants. The effect of infection on yield of sugar decreased linearly with later dates of infection and became almost negligible by harvest time, the loss of yield thus being roughly proportional to the time between the date of infection, as shown by the first symptoms, and that of harvesting. The loss of yield per 1,000 plants per week of infection was estimated at 10 lb. sugar, or 5 per cent. of the yield of healthy plants. Late infections, showing symptoms just before harvest, seemed to increase the yield, but this was considered to be due to the tendency for larger plants to be more liable to natural infection.

Little effect was produced on the loss of yield of sugar in infected plants by variation in the dates of sowing, but as late sowing reduced the yield in comparison with healthy plants this practice increased the percentage loss caused by infection. Late-sown crops were also more susceptible to natural infection. The loss of yield was highest where all plants were infected at the earliest date, at the end of June, and the symptoms appeared in July. In the 1941 and 1942 experiments, respectively, the losses were 36 and 24 cwt. sugar per acre, or 72 and 46 per cent. of the yields of healthy plants.

Variation in the date of harvest produced no significant alteration in the effect of disease, but later harvesting permitted a higher incidence of disease to be attained from late infections. Infections causing symptoms any time between July and early September produced comparable effects on crops gathered in late November or December. Thus, the time of entry of the pathogen into the crop is the main determinant factor in the extent of the effect on yield.

The loss of yield of tops and roots caused by infection was relatively smaller than that of sugar. The sugar content of the root was reduced by 1 to 2 per cent. of fresh weight. In this respect, August infections, showing symptoms in September, exerted rather less effect than those occurring earlier.

While the general conclusion to be drawn from these experiments is that control measures should be directed to the prevention of early infection, there is no known method of doing this. Effective control depends, therefore, rather on eliminating the sources of infection. Early sowing was shown to offer some control by reducing the susceptibility of the crop and was also beneficial in producing an increase in yield, where this had fallen sharply though infection, comparable with that in healthy crops.

The difficulty of forecasting yields in virus-ridden areas might be overcome, and an accurate assessment of disease loss made, by estimating on a number of occasions the rate of crop infection and assuming a constant rate of loss for each week. This requires determinations of the weekly rate of loss in absolute units or as percentage of the yield of healthy plants under a wide range of conditions.

Ark (P. A.) & Leach (L. D.). **Seed transmission of bacterial blight of Sugar Beet.**—*Phytopathology*, xxxvi, 7, pp. 549–553, 1 fig., 1946.

Phytomonas [*Pseudomonas*] *aptata*, previously known as the agent of a leaf spot of sugar beet, was found in 1943 to be responsible for foliar blight, black streaking of the seed stalks, and internal root necrosis of the same host in California and Oregon [*R.A.M.*, xxiv, p. 173]. Seeds from blighted stalks are heavily contaminated and give rise to diseased plants, but this mode of transmission of the causal organism was controlled in greenhouse tests by new improved ceresan as a dust (½ oz. per 100 lb. seed) or dip (1 in 1,200) and arasan dust (4 oz. per 100 lb.). Inoculation experiments gave positive results on sugar beet, [chilli] pepper, kidney bean (*Phaseolus vulgaris*), eggplant, lettuce [ibid., iv, p. 252], and nasturtium (*Tropaeolum majus*), all of which had already been found susceptible by Nellie A. Brown and Clara O. Jamieson (*J. agric. Res.*, i, pp. 189–210, 1913; *Science*, xxix, pp. 915–916, 1909), as well as on broad bean (*Vicia faba*) and Swiss chard (*Beta vulgaris* var. *cicla*).

Singh (U. B.). **Pythium collar-rot of field Pea at Cawnpore, United Provinces.**—*Curr. Sci.*, xv, 7, pp. 195–196, 1946.

A species of *Pythium* isolated from the soft, brown, water-soaked lesions on the collars of wilted pea plants at the Research Farm, Cawnpore, in February, 1946, readily formed antheridia, oogonia, and oospores on potato dextrose agar at 21° to 23° C. The pea has not hitherto been recorded as a host of *Pythium* in India. About a week later patches of similarly affected plants in waterlogged soil yielded the same fungus, occasionally accompanied by a *Fusarium*. Inoculation experiments on pea seedlings with the *Pythium* at 30° to 37° resulted in the development of typical necrotic symptoms from the fifth day onwards, followed by the death of the plants within a fortnight, while the uninfected controls remained healthy. The fungus was re-isolated from the dead plants. At 27° to 32° the *Pythium* formed zoosporangia and zoospores; the mode of emergence of the latter has not yet been observed and further studies are in progress.

Heintze (Miss S. G.). **Manganese deficiency in Peas and other crops in relation to the availability of soil manganese.**—*J. agric. Sci.*, xxxvi, 4, pp. 227–238, 2 graphs, 1946.

The author adduces evidence to show that crops sensitive to manganese deficiency are generally healthy on soils with more than 0·3 mg. per cent. exchangeable manganese, though they may be healthy on soils with less. In crops on fen and other soils manganese deficiency occurred where low exchangeable manganese and high nitrifiable nitrogen occurred together.

Pot tests demonstrated that the control of pea marsh spot [*R.A.M.*, xxiv, p. 173] required adequate manganese throughout seed formation, manganese accumulated in the plant before flowering being ineffective. Marsh spot was induced in peas in a soil rich in available manganese by the injection of simple inorganic and organic nitrogen compounds into the plant. In field tests, manganese sulphate and basic slag applied to marsh soils before sowing peas reduced marsh spot, but not enough to justify the use of these materials on soils which quickly oxidize manganous compounds. Laboratory and pot culture tests support the practical recommendation of late sprayings with manganese salts on such soils [cf. ibid., xix, p. 187].

Hedges (Florence). **Experiments on the overwintering in the soil of bacteria causing leaf and pod spots of Snap and Lima Beans.**—*Phytopathology*, xxxvi, 8, pp. 677–678, 1946.

When snap beans (*Phaseolus vulgaris*) or Lima beans (*P. lunatus* var. *macrocarpus*) were grown in soil where the previous year's crop had been heavily infected with *Pseudomonas medicaginis* var. *phaseolicola*, or in soil composted with plant material from the previous year's crops infected with this organism and *Xanthomonas phaseoli* or with *P. syringae*, no infection resulted. Overwintered infected material used as spray inoculum likewise failed to induce infection the following year [cf. *R.A.M.*, xxv, p. 89].

Zaumeyer (W. J.). **Field control of Bean rust with sulfur.**—Abs. in *Phytopathology*, xxxvi, 8, p. 689, 1946.

Notwithstanding environmental conditions in the broad bean [*Vicia faba*] growing areas of Colorado, Wyoming, and Montana, which were ideal for the development of rust [*Uromyces fabae*] in 1945, excellent control was obtained by sulphur-dusting at 20 to 25 lb. per acre. Control early in the season, when infection is usually sparse, is relatively simple and prevents a secondary spread. One dusting applied by most growers in early July before the plants covered the rows practically eliminated the disease at Greely, Colorado. Fields dusted twice showed an average yield of 1,600 to 1,800 lb. seed per acre as against 800 to 1,000 lb. in untreated

fields. At Bridger, Montana, where rust was widely prevalent, an average of 2,000 lb. clean seed per acre was obtained over a twice-dusted area of 330 acres, the highest yield being 2,369 lb. Once-dusted fields averaged 1,400 and undusted 1,016 lb. per acre, the poorest being 380.

Frazier (N. W.) & Freitag (J. H.). **Ten additional leafhopper vectors of the virus causing Pierce's disease of Grapes.**—*Phytopathology*, xxxvi, 8, pp. 634–637, 1946.

Ten additional species of leafhopper were shown experimentally to be vectors of the virus of Pierce's disease of vine [*R.A.M.*, xxv, p. 437], viz., *Carneocephala triguttata*, *Neokolla gothica*, *N. confluens*, *N. hieroglyphica*, *Cuerna occidentalis*, *Pagaronia triunata*, *P. 13-punctata*, *P. furcata*, *P. confusa*, and *Friscanua friscanus*. None of these appears to be of any importance in the field in spreading the virus to lucerne. All 14 vectors which have been demonstrated to transmit Pierce's disease virus are in the family Tettigoniellinae, of which every species so far tested has transmitted the virus. Of over 50 leafhopper species of other subfamilies none has been shown to be a vector.

Le Roux (M. S.). **Sunscald in table Grapes.**—*Fmg S. Afr.*, xxi, 245, pp. 506–510, 1 fig., 1 graph, 1946.

Observations made in a vineyard at Groot Drakenstein, western Cape Province, on the incidence of sunscald among 15 of the most important export varieties of grapes (all grafted on Jacquez rootstocks), each trained on four types of trellis system, showed that the percentage of sunscald ranged from 0·3 (Barlinka) to 33·6 (White Prince), though all the varieties had been given similar treatment for factors likely to influence sunscald (e.g., identical irrigation, sulphuring, and cultivation). The berries are most sensitive just before they attain their full size and until they begin to change colour. On the whole, the white and red varieties proved more susceptible than the black. Taking an average of the amount of sunscald present in three varieties for each system of trellising, on the low perold there was 37 per cent. sunscald, on the fish-spine 28 per cent., on the high perold 18 per cent., and on the slanting trellis 17 per cent. The higher percentage on the fish-spine as compared with high perold, which is of the same height, is attributed to the fact that in the former system the wires are all at the same height, with the result that the grapes hang free of the leaves, bunches on the outside often encountering the direct rays of the sun. The trellis affording the best protection is the slanting, 4 ft. 6 in. high, in spite of the fact that the grapes also hang free and that the trellis lies at an angle of 30° to the afternoon sun. The protection is ascribable to the breadth of the trellis, which is 5 ft., and to the fact that the vines can be pruned in such a way that the crop is not borne on the sides.

Growers are advised to give preference to the less sensitive varieties, such as Alphonse Lavallée and Waltham Cross, and to avoid White Prince, Flaming Tokay, Raisin Blanc, Almeira, and Prune de Cazouls, particularly in regions farther inland, e.g., Hex River, where humidity is low and sunscald common. If sensitive varieties are grown, trellises should be wide and reasonably high, and if there is still danger, they should run from east to west. Sulphur dusting, if applied at all during the hot days just before the grapes begin to soften or change colour, should be as light and even as possible. The grapes should also be kept free from dust. The fruit should be accustomed to strong light gradually, by starting to sucker and thin out the leaves in good time. Care must be used in exposing the branches, especially after a cool, early summer. The bloom should be protected against unnecessary rubbing. When the crop is thinned out, it is preferable to remove the bunches on the outside of the trellis which hang lowest. Ventilation should be adequate, and the vineyard must be kept moist.

Kemp (H. K.). **Grape Vine little leaf and its control.**—*J. Dep. Agric. S. Aust.*, l, 1, pp. 3–5, 2 figs., 1946.

Vine little leaf [*R.A.M.*, xxiii, p. 491] occurs over large areas of the irrigated and non-irrigated parts of South Australia. It has often been confused with court-noué, but in every case where zinc treatment [ibid., xxiv, pp. 7, 353] has been applied, rapid recovery has taken place. In the Barossa Valley zinc winter swab treatment in 1944 resulted in a 25 per cent. increase in one vineyard but in another in 1946 it had no effect. In the Morphett Vale district, although little leaf disappeared during the first season after treatment, no crop increase occurred until the second year. It is considered that there is no vine district in the State which may not be expected to respond to zinc treatment, and it is pointed out that the Grenache variety develops acute zinc deficiency before showing any symptoms. On spur-pruned vines the zinc swab (water 1 gal., agricultural zinc sulphate 2 lb., rhodamine R.D. or any other dye to colour) should be applied immediately after pruning. On rod-pruned vines the much less effective zinc foliage spray (zinc sulphate 5 lb., hydrated lime 3 lb., water 100 gals.) must be applied. Severely affected vines will probably require annual treatment, but tests are to be made to investigate this and also the injection method of treatment.

Morquer (R.). **Sur quelques Fusarium dans l'écoulement muqueux de la Vigne au printemps.** [On some *Fusarium* species found in the mucous exudate of the Vine in spring.]—*Bull. Soc. Hist. nat. Toulouse*, lxxv, pp. 193–208, 1940. [Abs. in *Rev. Bot. appl.*, xxii, 249–250, pp. 325–326, 1942. Received October, 1946.]

Several species of *Fusarium*, including *F. merismoides* and *F. avenaceum*, are able to vegetate abundantly and reproduce in the mucous exudate of vines in spring [*R.A.M.*, v, p. 593]. *F. merismoides* is reported for the first time from the vicinity of Toulouse taking part in the formation of mucilaginous masses growing on vine stems. The fungus obtains its nutriment from the sap that flows from wounds of all kinds. Attempts at artificial infection indicated that the fungus lives only as a saprophyte in the vine sap.

Boixo (Baron de). **Soufrages en 1945.** [Sulphur treatments in 1945.]—*Progr. agric. vitic.*, cxxv, 22–23, pp. 368–370, 1946.

Dusting tests against *Oidium* [*Uncinula necator*] carried out in the author's vineyard, Cuxous, France, in 1945 demonstrated that Narbonne sulphur containing 16 to 30 per cent. pure sulphur is entirely effective [*R.A.M.*, xxv, p. 490] and that yellow sulphur with 50 per cent. lime is as effective as pure sulphur.

Arnaud (G.). **La valeur pratique des essais d'anticryptogamiques viticoles.** [The practical value of tests with fungicides for use on Vines.]—*Prog. agric. vitic.*, cxxvi, 33–34, pp. 97–99, 1946.

In estimating the value of any treatment recommended for the control of vine diseases the cost of the materials and labour must be borne in mind. While laboratory tests of fungicides must be followed by field tests before a final recommendation can be made, the fact must not be overlooked that some field tests are made under conditions that have little bearing on everyday vineyard practice.

If a comparative test is made of different active products used against mildew [*Plasmopara viticola*] or if different concentrations of Bordeaux mixture are used, it will be found that the differences in effectiveness between these materials vary with the circumstances. The same applies when pure sulphur or sulphur mixed with different proportions of inert matter is used against *Oidium* [*Uncinula necator*]. As a general rule, the difference in relative effectiveness between poor, moderately good, and very good materials diminishes when conditions favour the fungus.

Further, such differences can become almost nil when conditions are optimum for the materials.

Conditions that favour the fungicide are: poor development of the parasite, owing to climatic factors or varietal resistance in the host, great care in application, the use of large quantities of the material, the training of the vines on palisades permitting better spray coverage, and the use of sprayers carried on the backs of the workmen. Factors which, on the other hand, accentuate the differences between the given products are: weather conditions favouring the parasite, the use of susceptible varieties, vines not trained on palisades, the use of large-scale spraying machinery, etc.

Final tests of fungicides for use on vines should be made under conditions of ordinary everyday vineyard practice, on vines cultivated in the usual way, and with the costs of material and labour strictly limited to what the grower can afford. The experiments should also be carried out by competent persons.

Heterogenesis and the origin of viruses.—*Nature, Lond.*, clviii, 4012, pp. 406–407, 1946.

During a discussion on the origin of viruses at a meeting of the Society for General Microbiology held at Leeds on 23rd July, 1946, the general concensus of opinion was that plant, animal, and bacterial viruses (bacteriophages) should be considered independently. F. C. Bawden, while apparently inclining to the heterogeneric view, pointed out that though virus-like proteins might be normal constituents of some plants, our methods of detecting them are as yet imperfect.

Trotter (A.). **Rassegna delle consultazioni e della attività della Sez. di Patologia vegetale dell' Osservatorio di Portici (Ist. di ricerca e speriment. scient. per la fitopatologia) a tutto il 1942.** [Review of the consultations given by and the activities of the plant pathological section of the Portici Observatory (Institute of Scientific Research and Experimentation in Phytopathology) up to 1942, inclusive.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno (Portici)*, x, pp. 1–64, 6 pl., 6 figs., 1946.

This report, which covers the years 1918 to 1942, inclusive, and is the first to be issued on the activities of phytopathological section of the Portici Observatory, summarizes the diseases recorded in Italy during that period, some of which have already been noticed from other sources.

Dastur (J. F.). **Report of the Imperial Mycologist.**—*Sci. Rep. agric. Res. Inst. New Delhi, 1944–5*, pp. 66–72, 1946.

Of the 82 wheat varieties tested during the period under review [cf. *R.A.M.*, xxii, p. 196] for their reaction to loose smut (*Ustilago tritici*) [ibid., xxv, p. 495], 39 did not contract infection and 26 were only mildly attacked. Of a further 39 submitted for trial by breeding specialists, 10 remained free from infection, while 10 others sustained only slight damage. Tests with *U. tritici* on a set of Indian wheats suggested the presence of two physiologic races in India, but tests carried out in Canada pointed to only one; further studies are planned.

The incidence of Karnal bunt of wheat (*Neovossia indica*) [ibid., xxiv, p. 224] was very low. Further experiments confirmed previous observations as to the aerial transmission of infection.

Of 28 pigeon pea (*Cajanus cajan*) varieties tested for their reactions to *Fusarium udum* [ibid., xx, p. 496], IP80 was immune, IP41 and Hybrid 5 (D419–2–4) showed up to 5 per cent. infection, and the rest were highly susceptible to the wilt. In an infested field plot IP80 developed 4 per cent. infection, C.15, A126–4–1, and Thadgam 1–4–7 up to 7 per cent., IP41, 12 per cent., and three others were highly susceptible.

The tubers of 40 potato varieties were tested for their response to infection by *F. solani*, the agent of a severe rot. Complete immunity after a month's exposure to attack under optimum conditions for the pathogen was exhibited by cult. 296, and 394, Aya Papa, and MO9, while only 5 per cent. infection developed in cult. 230, Hyb. 2, 9, 11, and 14, and JO7, the remainder being highly susceptible.

Potato virus A was isolated from the Phulwa and Darjeeling Red Round varieties and its identity established by the reactions it induced on the differential hosts [cf. ibid., xxv, p. 413]. The presence of *Solanum* viruses 1 and 2 [potato viruses X and Y] in combination in the President, Up-to-Date, and Epicure varieties was disclosed by the reactions of differential hosts to inoculation with juice from the diseased plants.

The epidemic of sugar-cane red rot (*Colletotrichum falcatum*) [*Physalospora tucumanensis*] is reported to have been effectively combated in the United Provinces and Bihar. Recent experiments have again demonstrated the transmissibility of infection on a considerable scale through contaminated soil and irrigation water, the nodal regions of the host being the most liable to attack; the fungus was found to survive for about six months in fallow land.

In 32 isolates out of 390 platings of diseased rice samples the spore measurements agreed with those of *Helminthosporium oryzae* [*Ophiobolus miyabeanus*].

Williams (R. O.). **Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1945.**—27 pp., 1946.

In further work on 'sudden death' of cloves in Zanzibar [*R.A.M.*, xxv, p. 100] intercropping has already produced a great improvement in the young trees, which have shown good growth and are now the bushy shape characteristic of good health. Measurements of clove trees growing under various nurse crops and shade trees confirmed earlier observations that those under banana and *Gliricidia* are the most vigorous and healthy. Spectrographic analyses of leaf samples from affected trees carried out at Long Ashton indicated the presence of manganese in quantities which would be toxic in England, while the phosphorus and calcium content was below the normal health limit. Other factors do not entirely support the view that any of these elements is the cause of the condition, but further investigations are being made on this point.

Scab [*Elsinoe fawcetti*] was serious on rough lemon stocks, but spraying with Bordeaux mixture gave some control. Premature fruit-fall in two citrus orchards was found to be due to *Alternaria citri*. Large areas of paddy rice were attacked by leaf spot due to *Helminthosporium* [? *oryzae*: ? *Ophiobolus miyabeanus*].

Report of the Director for the year ending 31st October, 1944.—*Bull. Conn. agric. Exp. Sta.* 484, pp. 68–71, 1945.

The most promising method for the control of Dutch elm disease [*Ceratostomella ulmi*] and *Verticillium* wilt of elm and maple [*Acer* spp.] appeared from the four years' investigations summarized in this report [cf. *R.A.M.*, xxiv, p. 220] to be internal chemotherapy [ibid., xxiii, p. 367]. It was ascertained that the fungal toxin responsible for the chief symptoms of Dutch elm disease may be inactivated by such chemicals as 8-hydroxyquinoline sulphate; that pre-infection treatments with materials such as 8-hydroxyquinoline benzoate may confer some resistance; and that post-infection treatments promptly applied may cure the condition. Other evidence showed that the removal of infected wood may be valuable in saving individual trees. Cankerworm [*Alsophila pometaria*] defoliation conspicuously increased the summer-time susceptibility of elms to fungal infection.

Fungicidal studies indicated that plants can be 'immunized' against certain diseases by watering the soil with dithane [ibid., xxiv, p. 220; xxv, p. 215]. It has been shown that chemicals to be used as fungicides can be selected on a basis

of their ability to inhibit the action of certain cell components, such as amines, amino acids, metals, sugars, etc.

When seedling peaches were injected by the top injection method with various chemicals before and after inoculation with the X-disease virus [ibid., xxv, p. 37] by budding, the results confirmed those of earlier experiments, showing that immunization resulted from the administration of *p*-aminobenzene sulphanilamide and that injury to the tree by this chemical was to some extent prevented by the addition of a 2 per cent. solution of maltose or dextrose. Injections after inoculation gave 100 per cent. control. Hydroquinone, zinc sulphate, dextrose, and maltose each gave some control. Dithane sprays gave good control of apple scab [*Venturia inaequalis*] at 4 and 2 lb. per 100 gals. in the early part of the season, but lost its effectiveness later, while higher dosages produced severe foliar injury. When zinc sulphate and lime were added, the efficiency was increased and injuriousness reduced. Thiosan [ibid., xxiii, p. 236] remained effective against scab throughout the season, its efficiency being enhanced by the addition of lead arsenate.

Studies on calcium and potassium nutrition in relation to potato scab [*Actinomyces scabies*] and cabbage club root [*Plasmodiophora brassicae*] showed that, as the ratio of available calcium to available potassium in the soil was shifted progressively from high calcium to high potassium, the response of both diseases was not a simple relationship but of a periodic nature.

Field tests on plant decomposition products confirmed the results of greenhouse experiments. Five plant products used as mulches on strawberries in a poorly drained soil varied in their harmful effects as measured by the incidence of black root [cf. ibid., xvi, pp. 518, 623; xx, p. 348], number of surviving plants, and weight and number of berries produced. Limited greenhouse tests with green manures incorporated in the soil indicated that some grasses, e.g., timothy [*Phleum pratense*], are more apt to produce toxins than certain non-graminicolous species, as measured by the incidence of black-root symptoms. Squash foot rot [unspecified] appears to be declining in Connecticut, probably because seedsmen have now realized that seed infection dies out during two years' storage and because the fungus has been unable to thrive in the soil during the drought conditions that have recently prevailed. Squash seed can be freed from the fungus by hot-water treatment, but two years' storage is more practicable.

The form of seedling damping-off prevalent in Connecticut is mostly due to *Pythium debaryanum*. An outbreak in 1944 was the worst experienced in 11 years. Experimental evidence showed that good results followed when the soil was sprinkled with formalin (1 pint per gal. water per 15 sq. yds.) while being raked over just before seeding. Well mixed in the top soil, this was as effective as formaldehyde dust, and much easier to apply. Seed treatment was rather less effective, the best results being given by fermate, followed (in order) by cuprocide, arasan, thiosan, and semesan. No reduction of germination followed the treatment, and the resultant control was commercially satisfactory, though not always complete.

Fifty-eighth Annual Report of the Kentucky Agricultural Experiment Station for the year 1945.—68 pp., 1946.

In this report [cf. *R.A.M.*, xxiv, p. 403] it is stated that the tobacco variety Ky 33 is resistant to *Fusarium* wilt [*F. oxysporum* var. *nicotianae*] and black root rot [*Thielaviopsis basicola*], while Ky 34 is resistant to both and to mosaic. The F_2 progeny of a cross between the two were also resistant to *F. oxysporum* var. *nicotianae*, and some had excellent plant characters. Further selections are being made. F_3 hybrids between Barnett, Ky 33, and Ky 34 show high resistance to *Fusarium* wilt, excellent plant characters, and resistance to mosaic [ibid., xxv, p. 423].

The tobacco-streak virus [ibid., xxii, p. 375; xxv, pp. 238, 369] was transferred by inoculation to tobacco from sweet clover [*Melilotus*] plants from roadsides in Harrison county and from the Experiment Station farm. There is no doubt, therefore, that sweet clover is a natural host of the virus. In transmission experiments with 70 selections and varieties of tobacco, slight differences in resistance were noted.

In further work with the 32 isolates of *Cercospora* [? *nicotianae*: ibid., xxiv, p. 404], infection and sporulation occurred on tobacco inoculated with the fungus from tobacco, lupin, *Petunia*, and pokeweed [*Phytolacca decandra*], but not when isolates from 11 other species were used. Infection and sporulation also occurred on beans [*Phaseolus vulgaris*] with isolates of the fungus from 27 other species and on beet, *Petunia*, pansy, cabbage, and cantaloupe with isolates from 6, 8, 9, 12, and 6 other species, respectively.

During the early part of the season, Burley tobacco was severely injured by brown root rot [ibid., xxiv, p. 405]. Most of the plants made good growth later, but yield and quality of the leaf were greatly reduced on some plots. The wide prevalence and severity of the condition are attributed to a cool, wet spring. The extent and severity of the disease did not appear to be associated with any particular grass or grass-legume combination or with the available fertility level. The disease was absent from or slight on fertile plots previously under bluegrass [*Poa annua* and *P. pratensis*]—white clover [*Trifolium repens*] for over 40 years and in tobacco grown either in two-year rotation or continuously.

Black root rot, as a result of the cool, wet spring and early summer, was exceptionally prevalent, and was very injurious to susceptible varieties of Burley tobacco. The resistant Ky 16 and Ky 41 A were slightly retarded, but gave a good yield.

No satisfactory variety of either Burley or dark tobacco carrying the Ambalema factor for mosaic resistance [cf. ibid., xxiii, p. 192; xxv, p. 283] has been developed yet at the Experiment Station. Three satisfactory varieties containing the N factor, Ky 150, Ky 151, and Ky 160, are being grown successfully by farmers.

Phloem necrosis continued to kill elms in ever-increasing numbers [ibid., xxiv, p. 436]. Dutch elm disease [*Ceratostomella ulmi*] was observed on two trees in Campbell county. Limited surveys along the Kentucky side of the Ohio river as far west as Henderson county revealed no further infections in that area, though *C. ulmi* appeared to be rather prevalent across the river in Ohio.

Rudd Jones (D.). **A medium for investigating the breakdown of pectin by bacteria.** —*Nature, Lond.*, clviii, 4018, p. 625, 1946.

During an investigation on bacteria associated with rotting of potatoes in storage a new method of testing isolates for ability to break down pectin was devised. A sodium pectate powder forming a gel at a neutral pH and in the absence of sugar was obtained, and a medium prepared as follows: a basal solution was made containing 1 gm. ammonium acid phosphate, 0·2 gm. potassium chloride, and 0·2 gm. magnesium sulphate per l. distilled water with 50 ml. per l. of McIlvaines's phosphate (0·2 M)-citrate (0·1 M) buffer solution. The mixture was heated to 70° C. and sufficient of the sodium pectate added to give a 1 per cent. concentration. It was then raised nearly to boiling-point and kept at this temperature for about five minutes, being stirred meantime. Bromo thymol-blue was added as an indicator. The medium was then tubed and sterilized by raising it momentarily to 120° and allowing to cool. Setting was induced by calcium ions (approximately 3·2 per cent. of the powder), which converted some of the sodium pectate to calcium pectate on cooling. The addition of a small proportion of a 10 per cent. solution of calcium chloride increased the structural viscosity.

Tubes inoculated by needle stabs from broth cultures of *Bacterium phytophthorum* [*Erwinia phytophthora*], *Bact. carotovorum* [*E. carotovora*], *Bact.* [*E.*] *aroideae*, and *Bacillus polymyxa* [*R.A.M.*, xxii, p. 493] showed slight liquefaction after two days at 25°, liquefaction being almost complete after a week. *Pseudomonas fluorescens* did not liquefy the medium after 20 days. *Botrytis cinerea* and *Sclerotinia minor* also produced liquefaction. Evidence was obtained that liquefaction of a pectate gel and loss of coherence in plant tissue appear to be correlated.

Baker (R. E. D.). **Cacao virus diseases.**—*Proc. agric. Soc. Trin. Tob.*, xlv, 4, pp. 289, 291–294, 1945.

After referring to the discovery by Posnette of cacao red mottle and vein-clearing in Trinidad in 1943 [*R.A.M.*, xxv, p. 296] the author states that the disease still appears to be confined to the north-western part of the island, particularly the valleys of Maracas, Santa Cruz, and Diego Martin. Visits to eastern Venezuela, Tobago, Grenada, St. Vincent, and Dominica indicated that these localities are probably unaffected. The chief symptoms are leaf mosaic and pod and leaf red mottle, but in a mixed seedling population such as is found in most Trinidad cacao fields the symptoms vary from tree to tree, and in vegetatively propagated material from clone to clone. There is reason to believe that two strains of the disease occur, differing slightly in their symptoms on different clones; both appear to be present in the Santa Cruz valley, one only (A) at Diego Martin, the other (B) only in Maracas. The symptoms indicate that these strains resemble certain strains of cacao virus found in West Africa but are not identical with them. The symptoms are not always constant or reliable, a tree known to be infected sometimes producing a flush without symptoms. Spread is slow, new outbreaks occurring at short distances only. The disease damages the trees and significantly reduces yield, and the wholesale eradication of the condition at an early date is advised.

Thorold (C. A.). **Cacao virus disease.**—*Proc. agric. Soc. Trin. Tob.*, xlv, 4, pp. 295, 297–299, 1945.

To attempt the eradication of cacao virus disease from Trinidad [see preceding abstract] provision has been made for an intensive survey to be carried out by a staff of inspectors who will have the right of entry to estates and power to destroy trees where necessary. At the start, no tree will be destroyed without reference to the Plant Pathologist. All nursery trees at La Pastora Propagating Station were examined, and none was found to be affected. Of 10,193 trees examined in the Santa Cruz valley during ten days' inspection, 534, or about 5 per cent., were affected, the figures on the different properties ranging from 0 to 31 per cent.

Sprague (R.). **Rootrots and leafspots of grains and grasses in the northern Great Plains and western States.**—*Plant Dis. Reptr, Suppl.* 163, 267 pp., 1946. [Mimeographed.]

This copiously annotated compilation includes references to some 220 species and subdivisions of species of parasitic fungi found growing naturally on Gramineae in the northern Great Plains and western States of the American Union [*R.A.M.*, xxiv, p. 221; xxv, p. 345], as well as to a few disorders of indeterminate or non-parasitic origin. The fungi comprise 13 Phycomycetes, 24 Ascomycetes, 8 Basidiomycetes, and 162 Fungi Imperfecti, and under each fungus brief summaries are given of the symptoms, host range, sometimes morphology, and less often of taxonomy. A bibliography of 782 titles and host and fungus indices are appended.

Oort (A. J. P.). **Is de Berberis een gevaar voor de Graancultuur?** [Is the *Berberis* a threat to cereal cultivation?]—*Tijdschr. PlZiekt.*, xlvii, 3, pp. 112–119, 1 pl., 1941. [Received November, 1946.]

In 1940 wheat black rust (*Puccinia graminis*) developed prematurely and with exceptional severity in Holland, where little is known concerning the occurrence of the disease in previous years and a more intensive study is desirable. In many places there was an obvious connexion between the rust outbreaks and proximity to the crops of the susceptible common barberry, the eradication of which may well assume considerable local importance as a control measure. Since some of the ornamental barberries, e.g., *Berberis thunbergii*, are immune [*R.A.M.*, xvii, pp. 102, 603, *et passim*], a revision of the species cultivated in parks and gardens should be undertaken, paying attention to their reactions to black rust.

Johnson (T.) & Newton (Margaret). **The occurrence of new strains of Puccinia triticina in Canada and their bearing on varietal reaction.**—*Sci. Agric.*, xxvi, 9, pp. 468–478, 1 fig., 1946.

Strains of leaf [brown] rust (*Puccinia triticina*) have been found in Canada which are able to cause heavy infection of Regent wheat and other varieties usually displaying high resistance to this rust [cf. *R.A.M.*, xxiv, p. 495]. Some of these strains are biotypes of known races, such as 5 and 15 [ibid., xxii, p. 199], but the one most commonly present is 128, which closely resembles 29, but differs from it in its ability to infect Regent, Renown, and Redman severely in the adult stage. It was first identified in Canada in 1944, when it comprised 12 per cent. of all brown-rust isolates, increasing in 1945 to 26 per cent. and representing 66 per cent. of those from Regent, Renown, and Coronation.

The new strains that appear to have overcome the resistance of Regent have not affected that of K–33, Chinese × Marquis, or Warden × Hybrid English W 325. Hybrids from the cross between the hybrid McMurachy × (Warden × Hybrid English W 325) and Redman showed rather marked resistance to all the brown-rust races with which they were tested, including strains of the rust able to infect Regent and Redman severely. The South American varieties Frontana, Fronteira, and La Prevision 25 were also highly resistant to the 13 strains of brown rust used.

Lejeune (A. J.). **Correlated inheritance of stem rust reaction, nitrogen content of grain and kernel weight in a Barley cross.**—*Sci. Agric.*, xxvi, 5, pp. 198–211, 2 pl., 4 graphs, 1946.

In breeding work at the University of Manitoba for the production of a smooth-awned barley variety of good malting quality resistant to stem [black] rust (*Puccinia graminis tritici*) [cf. *R.A.M.*, xxv, pp. 259, 552] it was found that in the cross O.A.C. 21 × Chevron inheritance of black-rust reaction was governed by a single factor pair with resistance dominant. This factor is thought to be probably the same as that found in Peatland [ibid., xii, p. 753]. Nitrogen-content inheritance was governed by multiple factors, and a definite tendency was observed for nitrogen content in the F_3 progeny to be higher than that of the parents genetically comparable for the black-rust factor. Inheritance of kernel weight was also governed by multiple factors, with a definite tendency towards lower kernel weight in the F_3 progeny than in the parents. Few, if any, of the factors for nitrogen content were linked with black-rust reaction, though some of them appeared to be associated with it indirectly through its relation to kernel weight, resulting in a weak association of high nitrogen content and rust resistance. A large proportion of the factors for 1,000-kernel weight appeared to be fairly closely linked with black-rust reaction, resistance being associated with low kernel weight; when a much larger population was used, however, this linkage was broken. Therefore in similar breeding programmes it would be necessary to use large populations.

Grasso (V.). **First contribution to the study of Wheat bunt in Italy.**—*Int. Bull. Pl. Prot.*, xx, 7–8, pp. 66M–68M, 2 figs., 1946.

After pointing out that wheat bunt in Italy is caused by *Tilletia foetens* [*T. foetida*] and *T. tritici* [*T. caries*], the author states that the latter species was prevalent in the north [cf. *R.A.M.*, xxii, p. 14], whereas in specimens from the centre and south 98 per cent. of the infection was due to *T. foetida*, and scarcely 2 per cent. to *T. caries*. These percentages were the same for all localities and for all of the infected varieties examined, i.e., Mentana, Roma, and Frassineto. Both smut species were found in nature at the same time on the same caryopsis, irrespective of the locality and of the variety of wheat affected. The finding of partially infected grains with spores inside between the pericarp and endosperm indicates that a new method of treating wheat against bunt will have to be adopted, to control the fungus inside as well as outside the grain.

Sempio (C.). **Metabolism of the Wheat—Erysiphe graminis 'complex'.**—*Int. Bull. Pl. Prot.*, xx, 7–8, pp. 49M–65M, 2 figs., 5 graphs, 1946.

Studies are described on the rate of respiration, glycolysis, transpiration, and photosynthesis of wheat of three varieties affected by *Erysiphe graminis* during the full cycle of the disease. For measuring respiration and glycolysis Warburg's method was used, for transpiration the ratio between fresh and dry weight was compared in both healthy and affected plants, while for photosynthesis the author devised a method based on the amount of carbon dioxide fixed by the green tissues.

The results showed that in infected plants respiration was at first slightly higher than in healthy ones, and rose rapidly, reaching a maximum (sometimes four times the normal rate) as the conidia formed. It then declined somewhat as the disease approached its termination, but remained well above normal. During the two or three days after inoculation photosynthesis was stimulated; during the expansion of the mycelium it fell usually below that of the healthy controls, rising above normal during conidial formation and finally falling to values less than half those for healthy plants. Glycolysis was appreciably stimulated during the early stages of incubation; it then fell below normal, this difference increasing progressively as the disease advanced. Transpiration was at first normal, but towards the third or fourth day it increased, and remained high. The possible significance of these results is discussed in detail.

Garrett (S. D.). **Reduction of take-all by artificial fertilizers.**—*J. Minist. Agric.*, liii, 5, pp. 223–225, 1946.

The author briefly adduces evidence obtained by various workers in different parts of the world showing that loss in yield of cereals caused by *Ophiobolus graminis* [*R.A.M.*, xxv, p. 338] decreases with increase in soil fertility. The free use of fertilizers is urged to minimize the risks attendant upon intensive and continuous cereal cultivation, but at the same time it is emphasized that the only lasting and satisfactory method of controlling *O. graminis* (and also *Cercosporella herpotrichoides*) is sound rotation. Other methods of controlling take-all, such as the preparation of a firm seed-bed, care in the use of lime, and proper control of carrier weeds, should not be neglected.

James (N.), Wilson (Joyce), & Stark (E.). **The microflora of stored Wheat.**—*Canad. J. Res.*, Sect. C, xxiv, 5, pp. 224–233, 6 graphs, 1946.

Examination of four grades of Manitoba Northern red spring and No. 5 and No. 6 wheats delivered to the Winnipeg market in 1943 and 1945 disclosed a considerable number of micro-organisms. They were not found on all kernels, but were present in all the 10-gm. samples tested. The high-grade No. 1 Manitoba

Northern showed the lightest infestation which became progressively greater on each lower grade of wheat. The numbers of organisms per gm. of seed were: bacteria 280,000 to 164,000,000, yeasts 6,200 to 64,000, and fungi 420 to 1,870.

One of the two principal contaminants was identified as *Bacterium herbicola aureum* [?*Pseudomonas trifolii*] and the other as a species of *Pseudomonas*, differing from *P. fluorescens* in its strong tendency to slime formation, its lack of colour on nutrient agar, gelatine, or broth, and its inability to reduce nitrates or to form acid from dextrose.

In selections of fungus colonies from a large number of plates made from the first washings *Penicillium* spp. predominated, with *P. chrysogenum*, *P. frequentans*, and *P. terrestre* most frequently noted; species of *Aspergillus*, *Alternaria*, *Fusarium* [*R.A.M.*, xxiv, p. 143], and *Cladosporium* also accounted for a considerable proportion of the colonies. The following in addition were identified: *A. tenuis*, *Acrostalagmus cinnabarinus*, *Aspergillus candidus*, *A. flavus*, *A. fumigatus*, *A. glaucus*, *A. niger*, *A. oryzae*, *A. versicolor*, *Botrytis cinerea*, *Cephalosporium curtipes* and other *C.* spp., *Cephalothecium* [*Trichothecium*] *roseum*, *Cladosporium herbarum*, *F. culmorum*, *F. poae*, *F. scirpi* var. *acuminatum*, *F. semitectum* var. *majus*, *Helminthosporium sativum*, *Hormodendrum pallidum*, *H. viride*, *Monilia* spp., *Mucor circinelloides*, *M. racemosus*, *Paecilomyces varioti*, *Penicillium flavidorsum*, *P. purpurogenum*, *P. rugulosum*, *P. spinulosum*, *Phoma* spp., *Rhizopus* spp., *Scopulariopsis brevicaulis*, *Septoria nodorum* [ibid., xxiv, p. 222], *Torula* spp., and *Trichoderma lignorum* [*T. viride*].

All except *Trichothecium roseum*, *S. nodorum*, *F. semitectum*, *A. oryzae*, and the *A. glaucus* group of the above species have been isolated from Manitoba soils [ibid., xiv, p. 791], and *Alternaria tenuis*, *Aspergillus niger*, *T. roseum*, *C. herbarum*, *F. culmorum*, *H. sativum*, and *S. nodorum* are listed in Orton's bibliography of seed-borne parasites [ibid., xi, p. 386].

The bacteria cannot be regarded as mere chance contaminants, but must be types that develop on the grain, as they are present on a sufficiently large number to account for the enormous population on all the samples studied. It is also clear that their presence is not due to any defect in the grain, and they must be considered as commensals developing on the seed coat or in its intercellular spaces. They must be able to proliferate under the conditions of grain storage or, at least. to withstand such an atmosphere for long periods.

As epiphytic yeasts were found in relatively small numbers, fluctuating errati cally from one sample to another, they are probably of little practical importance. The rest of the fungal population can hardly be regarded as epiphytic. The fact that it is small at the moisture level of stored wheat appears to indicate that it is not the result of multiplication. It is, however, persistent, which probably means that spores are held mechanically and protected in creases or crevices. In general, it represents species that occur commonly in soil and dust in large numbers.

Storage of bulk Wheat grain in ventilated bins.—*J. Minist. Agric.*, liii, 5, pp. 199–201, 1946.

Experimental evidence showed that when air was blown through a bin from inverted troughs at the base at the rate of 20 cu. ft. per minute per ton of stored wheat grain, grain with 20 per cent. water content remained cool and free from visual damage for a fortnight, while grain of 26 per cent. water content was kept safely for two or three days by periodic ventilation. Grain in a moist condition, though kept cool in this way, was gradually attacked by mould [unspecified], and its germination impaired. The amount of air required depended on the difference between grain and air temperatures and on the relative humidity of the air. Under average atmospheric conditions, with a reasonable depth of grain and as high a velocity as is practicable, it was found, however, that grain of 20 per cent. water content could

not be stored without some deterioration, and was not dried to a safe level. It is concluded that pre-storage ventilation with atmospheric air is suitable only for grain of 17 per cent. or less water content. As combine-harvested grain usually has a higher water content, cold air ventilation cannot be relied on to obviate the use of a drier.

In another experiment a bin of wheat was treated successfully by passing through it air raised 8° to 16° F. above air temperature, at the rate of 45 cu. ft. per minute per ton. The water content of the grain was reduced from 19·5 to 15 per cent. in 14 days with no sign of deterioration. This experiment is to be repeated on a farm scale.

KUNKEL (L. O.). **Leafhopper transmission of Corn stunt.**—*Proc. nat. Acad. Sci., Wash.*, xxxii, 9, pp. 246–247, 1946.

In attempts to transmit the new maize disease recently recorded from California and Texas [*R.A.M.*, xxiv, p. 498], and which the author designates 'stunt', 14 healthy plants of the variety Golden Bantam were exposed for four days to approximately 150 adult leafhoppers (*Baldulus maidis*) hatched and reared on a diseased maize plant. Fourteen other plants of the same age and variety were similarly exposed to virus-free leafhoppers. All the plants exposed to the first colony showed stunt five to six weeks after exposure, while all the others remained healthy during three months' observation. In another test, seven of 16 New Jersey No. 2 field maize plants exposed for one day to a colony of the insects hatched and reared on an affected plant showed stunt in 34 to 38 days after exposure, though all of 16 similar plants exposed to virus-free leafhoppers remained healthy. A further experiment gave similar results, all the evidence obtained demonstrating clearly that maize stunt is readily transmitted by this leafhopper.

CHALAUD (G.). **Sur la biologie de Fusarium heterosporum Nees (F. lolii (W. G. Sm.) Sacc.).** [On the biology of *Fusarium heterosporum* Nees (*F. lolii* (W. G. Sm.) Sacc.]—*Bull. Soc. Sci. Bretagne*, xvii, 3–4, pp. 127–136, 12 figs., 1940 (issued 1941). [Received 1945.]

Fusarium heterosporum [*R.A.M.*, xxii, p. 265] occurs in the autumn in the vicinity of Rennes, Brittany, on the flowers of *Agropyron repens* and *Lolium perenne*, pursuing a saprophytic existence on the honeydew exuded as a sequel to the attacks of *Claviceps purpurea* [ibid., x, p. 23; xiii, p. 382]. In relation to the true parasite, *F. heterosporum* behaves as a commensal antagonist, considerably hampering the growth of the former and often preventing sclerotial production. The material collected by the writer consisted of a red to orange stroma, dendriform conidiophores, and arcuate-fusiform, mostly triseptate conidia, 18 to 34 by 3·5 to 4·2μ (occasionally attaining a length of up to 60μ, with seven or more septa).

LOUCKS (K. W.) & HOPKINS (E. F.). **A study of the occurrence of Phomopsis and of Diplodia rots in Florida Oranges under various conditions and treatments.**—*Phytopathology*, xxxvi, 9, pp. 750–757, 7 graphs, 1946.

From some 4,000 isolations yielded by 850 separate samples of 50 oranges each, statistical analyses were made at the Citrus Experiment Station, Lake Alfred, Florida, of the incidence of stem-end rot (*Diaporthe citri* and *Diplodia natalensis*) in fruits of the Hamlin, Parson Brown, Pineapple, and Valencia varieties treated against the disease by debuttoning, gassing with ethylene, soaking in borax, wrapping in diphenyl-impregnated paper, calyx removal by various methods, storage at high or low relative humidity (90±4 per cent. and 79±3° F. or 56± 7 per cent. and 75°, respectively), and different combinations of these procedures.

No correlation could be established between the occurrence of the two fungi in the same fruit. The amount of infection by both organisms was reduced by

debuttoning and by five minutes' immersion in a 5 per cent. borax solution before or before and after gassing, while removal of the calyx alone decreased the incidence of *Diaporthe citri* but not that of *Diplodia natalensis*. Borax alone was effective against *D. natalensis* only. Gassing with ethylene for 48 hours at 85° and 90 per cent. relative humidity was not only ineffectual as a control measure but actually promoted invasion by *D. natalensis*. Wetting the fruit after picking did not affect either of the fungi, but *D. natalensis* was favoured by a high relative humidity in the storage room. The use of diphenyl-treated wraps [*R.A.M.*, xxiii, pp. 104, 252] failed to prevent infection by either of the pathogens.

Viennot-Bourgin (G.) & Brun (J.). **Sur la présence du 'sour rot' des Agrumes en France.** [On the presence of Citrus sour rot in France.]—*Rev. Bot. appl.*, xxv, 275–276, pp. 10–15, 2 figs., 1945.

Early in 1944, the authors observed *Oospora citri-aurantii* [*R.A.M.*, vii, p. 163; xxi, p. 352, *et passim*] on sour orange (*Citrus bigaradia*) [*C. aurantium*] fruits from the south of France on sale in the Paris market [ibid., xxv, p. 557]. When the affected fruits were left in the open air they rapidly collapsed, the flesh becoming partially deliquescent; when they were placed in a dry atmosphere at a constant temperature of 12° C., they became mummified. The results of inoculation experiments showed that infection resulted only when spores were placed on the pulp, the mycelium appearing six to eight days after the pulp had become soft and the skin had collapsed and become translucid. When deep inoculations were made into the flesh, characteristic sour-rot symptoms developed in four or five days. These results indicate that *O. citri-aurantii* is an active parasite which causes a rapid generalized rot of sour oranges, infection occurring on mature fruits as a result of deep wounds in the flesh; superficial scratches are of no importance. In southern France wounds facilitating infection probably result from insect attack.

Roumain (P.). **La mort de nos Cocotiers et le problème de la quarantaine.** [The death of our Coco-nut Palms and the quarantine problem.]—*Rev. agric. Haiti*, i, 2, pp. 75–82, 1945.

The coco-nut disease referred in Jamaica to bronze leaf wilt (though as explained in a footnote it is now held by Leach to be distinct) [Leach's 'unknown disease' of coco-nut: *R.A.M.*, xxv, p. 447] is stated to be a limiting factor in coco-nut production in Haiti, where it occurs, as in Jamaica [ibid., xxiv, pp. 354, 367], on all types of soil. The available information on the disease is summarized and the following approach to the quarantine problem proposed. Agronomists and agricultural agents should carefully examine the palms in their respective sectors and immediately notify the Central Bureau of any suspected cases of the disease. In the north, north-eastern, and Gonaives agricultural districts diseased palms should be felled and totally destroyed by fire. No new coco-nut plantings should be laid down for many years to come, either in the areas already invaded or (even more important) in those, such as Jean-Rabel, where the wilt has not yet appeared.

Malençon (G.). **L'infection florale du Dattier par le Fusarium albedinis (Kill. et Maire) Mlçn.** [Floral infection of the Date Palm by *Fusarium albedinis* (Kill. & Maire) Mlçn.]—*C. R. Acad. Sci., Paris*, ccxxiii, 22, pp. 923–925, 1946.

The inoculation of date palm inflorescences with a microconidial suspension of *Fusarium* [*Cylindrophora*] *albedinis*, the agent of baïoud disease [in Morocco: *R.A.M.*, xiii, p. 505], resulted in the deep penetration of the carpels by the hyphae of the fungus, which insinuated themselves between the parenchyma cells and progressively destroyed them. The pathogen is evidently dependent on pectic

compounds for its sustenance, since it was capable of entry only through the mucilaginous mass coagulating on the papillae on the surface of the stigmata and pursued its search for them in the underlying tissues.

ALBERT (W. B.). **The effects of certain nutrient treatments upon the resistance of Cotton to Fusarium vasinfectum.**—*Phytopathology*, xxxvi, 9, pp. 703–716, 6 graphs, 1946.

A tabulated account is given of the writer's experiments at Clemson Agricultural College, South Carolina, in 1943–4 to determine the reactions of the Half and Half cotton variety, which is highly susceptible to wilt (*Fusarium vasinfectum*), to different sources of nitrogen at two pH levels, 6·6 to 6·8 and 5 to 5·3 [cf. *R.A.M.*, vii, p. 320; xix, p. 403; xx, p. 268], using Armstrong's technique for the growth of cultures for inoculation [ibid., xx, p. 531].

Plants grown in the high pH calcium nitrate solutions contracted markedly less wilt and their mortality was lower than those in any other solution, whereas severe symptoms developed more rapidly in plants in solutions of the same compound at the low pH than in those of any other series. Similar adverse effects were exerted by ammonium nitrate at the low pH. The course of the disease was slower in plants grown in solutions containing only nitrogen from ammonium sulphate than in those of the low pH calcium nitrate or ammonium nitrate series. Two interdependent factors, a pH of 6·6 to 7 and nitrate nitrogen derived from calcium nitrate at the particular nutrient balance used, are believed to have contributed significantly to an increase in wilt resistance.

SCHEER (D.). **Ein neuer parasitärer Pilz aus dem Darm der Wasserassel (Asellus aquaticus L.).** [A new parasitic fungus from the intestine of the Water Hoglouse (*Asellus aquaticus* L.).]—*Z. Parasitenk.*, xiii, 3, pp. 275–282, 12 figs., 1944. [Received November, 1946.]

The water hoglouse (*Asellus aquaticus*), a valuable food for fish in ponds in Upper Silesia, Germany, is parasitized by a hitherto undescribed fungus, to which the name *Rectichaerella aselli* n.g., n.sp. is assigned. The diameter of the regularly branched, septate hyphae ranges from 6 to 20μ, and their maximum length is 2·8 mm. They disintegrate for almost their full length into conidia, which germinate to produce new hyphae. The host does not appear to suffer from the fungal infection.

COLHOUN (J.). **Observations on the effects of browning (Polyspora lini Laff.) of Flax on seed production.**—*Ann. appl. Biol.*, xxxiii, 3, pp. 255–259, 1946.

During experiments carried out in 1941, 1942, and 1944 on the disinfection of flax seed against *Polyspora lini* [*R.A.M.*, xxii, p. 358; xxiv, p. 370], it was found that the *M* weight (of 1,000 seeds) of heavy or winnowed seeds harvested and the incidence of browning were inversely related; as the incidence of the browning became more severe the *M* weight of the winnowed seeds declined. On the whole, maturing seeds in a crop grown from heavily infected seeds appear to acquire infection earlier than those in comparable crops produced from less heavily contaminated or from disinfected seeds. The fact that during several seasons *P. lini* has been observed to spread less rapidly in crops from treated than from untreated seed supports this hypothesis.

In 1942 a direct and significant correlation was shown to exist between the incidence of browning and the percentage number of poorly developed, light-weight seeds, and these were more heavily contaminated with *P. lini* than the heavy-weight seeds from the same crop whether disinfected or not. Also the incidence of the disease was directly related to the number of heavy seeds infected

at harvest, a result according with the findings of Kazina in 1935 [ibid., xv, p. 652]. Unpublished records for Northern Ireland indicate, however, that this relationship is not found in every season.

Seed from apparently healthy plants was almost completely free from infection and a high percentage of it was heavy-grade. Plants with marked browning yielded quite a high proportion of disease-free seed. The percentage germination of heavy seeds was not reduced by the intensity of browning [loc. cit.] in the crop or the incidence of the pathogen on the seed.

The effect of seed treatment, therefore, is to reduce browning and also to increase the quantity and quality of heavy-grade seed.

COLHOUN (J.). **The relation between the contamination of Flax seed with Polyspora lini Laff. and Colletotrichum linicola Pethybr. & Laff. and the incidence of disease in the crop.**—*Ann. appl. Biol.*, xxxiii, 3, pp. 260–263, 1946.

In view of the difficulty experienced in eliminating *Polyspora lini* from flax seed by seed treatment [*R.A.M.*, xxii, p. 358 and preceding abstract], it was considered necessary to study the effect of using infected seed, and the relation between the degree of infection and the incidence of the disease in the crop [ibid., xv, p. 652]. Only naturally contaminated seeds were used and *Colletotrichum linicola* was included in the investigation, as no satisfactory control of this parasite by seed treatment had been obtained by 1940, when these experiments were begun.

From seed of several varieties 30 samples were chosen giving a range of contamination with *P. lini* from 0 to 35·2 per cent., and 17 with *C. linicola* infection ranging from 0 to 46·6 per cent. The crops from seed infected by the former did not develop serious disease where seed-contamination was less than 5 per cent. The varieties Stormont Cirrus, Liral Monarch, and Liral Crown from seed with 0·2 per cent. contamination showed no infection in the early phases and only 1, 0·5, and 0 browning respectively [on a scale where 0 is no disease and 10 is maximum] by the end of June, 1940. Stormont Cirrus seed with 7·8 to 35·2 per cent. seed contamination showed generally maximum infection at all stages of growth.

The results obtained with *C. linicola* in 1940 showed that incidence of the disease in the seedling phase is related to the percentage of contaminated seeds, maximum attacks occurring when seed infection was 13·2 per cent. in Liral Dominion, 32·4 in Liral Monarch, and 21·2 in Liral Crown.

In further experiments in 1942 with Liral Prince and Liral Crown, seed samples, carrying varying degrees of contamination with either *P. lini* or *C. linicola*, were prepared from heavily contaminated samples by mixing varying quantities of healthy seed of the same variety with them. The percentage number of plants infected with *P. lini* in the seedling or stem-break stages was in general related to the percentage of contaminated seeds. Seedling infection was less than 5 per cent. when seed-contamination was 15·6 per cent. or less in Liral Prince and 19 per cent. or less in Liral Crown, but at the stem-break stage only plants from seed with 1·6 per cent. or less contamination showed under 5 per cent. attack.

With *C. linicola* agreement was also shown between the percentage contamination of the seed and the number of infected plants, although it was less striking than in the case of *P. lini*, due probably to the more rapid spread of *C. linicola* from plant to plant.

MUSKETT (A. E.) & COLHOUN (J.). **Seedborne diseases of Flax and their control.**—*Ann. appl. Biol.*, xxxiii, 3, pp. 331–333, 1946.

At a joint meeting of the Association of Applied Biologists and the Microbiological Panel of the Food Group of the Society of Chemical Industry on 12th April, 1946, the authors reviewed the work that has been done in Northern Ireland

on the control of seed-borne diseases. The production of 100,000 acres of flax a year from seed supplied from the United Kingdom crops was an undertaking to which the mass production of nomersan [*R.A.M.*, xxii, p. 359] greatly contributed. The disinfection of all seed for sowing purposes, the testing of all bulk samples for moisture content, purity, and germination, and the rejection of all seed below standard have now been generally adopted in the British Isles.

A comprehensive survey of flax seed produced in the United Kingdom has been carried out during the past three years. Some 5,000 samples have been examined by the Ulster method [ibid., xx, p. 261] for contamination with *Colletotrichum linicola* and *Polyspora lini* [see preceding abstracts], *Botrytis* sp. [ibid., xxiii, p. 132], *Phoma* sp. [ibid., xxv, p. 33], and *Fusarium lini* [ibid., xxiv, p. 58], the last-named being of little concern in the British Isles as a seed-borne parasite because of its rare appearance as a seed-contaminant. The survey has shown that flax seed produced in the south and east of England is much freer from seed-borne parasites than that from the wetter, northern and western parts of the British Isles. Seed contamination may be said to be much higher north and west of the Pennines than to the south and east, although flax rust (*Melampsora lini*) [ibid., xxv, p. 114] is found far more frequently in crops grown from seed produced in south and east England than from that produced in the north and west.

Apart from *Phoma*, which was not present to any extent until 1943, *C. linicola* has proved to be the most dangerous seed-borne pathogen, a progressive increase having been observed in seed stocks produced in the north and west of the British Isles. As a result, however, of the general adoption of seed-disinfection, which is remarkably effective against *C. linicola*, no epidemic of seedling blight in the flax crop occurred during the recent war such as caused serious losses in 1914 to 1918. Some £2,000,000 is estimated to have been saved by this. The inclusive cost of disinfecting sufficient seed to sow one acre is half a crown.

Millikan (C. R.). **Frost injury to Flax.**—*J. Dep. Agric. Vict.*, xliv, 8, pp. 381–384, 6 figs., 1946.

A detailed description of frost damage to flax in Victoria where it is not uncommon. Affected plants generally occur individually or in small isolated lengths of drill row, random in distribution. Young plants in thickly sown patches appear to be more susceptible than those normally spaced.

Laboratory experiments showed that flax is most sensitive to frost in the two-leaf stage, after which it rapidly becomes very resistant until it is at least 4 or 5 in. high; with increasing age, it then again shows sensitivity. Susceptibility to frost is increased by soil waterlogging.

Thomas (I.) & Millington (A. J.). **Flax and Linseed breeding in W.A. Wada, a new rust resistant Flax variety.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxiii, 1, pp. 39–42, 2 figs., 1946.

With a view to establishing flax and linseed as commercial crops in Western Australia, the linseed variety, Punjab, an Indian type grown widely under irrigation in California, was introduced and cultivated. Owing, however, to its susceptibility to a local race of rust [*Melampsora lini*], and its relatively late maturity, which exposed the seed pods to cutworm attack, the establishment of a linseed-growing industry had to be abandoned. For breeding purposes several very early maturing and rust-resistant strains are being increased for commercial testing at the Avondale Research Station.

An early maturing and rust-resistant flax variety, Wada [*R.A.M.*, xxvi, p. 15], has been bred by A. J. Millington from a few rust-resistant Riga Crown plants, a variety originating in the Baltic States. Wada resembles Liral Crown in growth habit and appearance, but is slightly taller.

Cass Smith (W. P.) & Harvey (H. L.). **Flax rust in Western Australia.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxiii, 1, pp. 42–44, 1946.

Flax rust (*Melampsora lini*) has proved a major limiting factor in Western Australia to the economic production of this crop [see preceding abstract], which was expanded during the war and is menaced thereby in its permanent establishment as a peace-time industry in the State. Although the loss in the fibre varieties has not been so serious as in linseed, straw yields were reduced by 20 per cent. in 1942, with a 10 per cent. drop in straw values over roughly 8,000 acres.

Six races of the rust have now been identified from Western Australia and ten provisionally determined for Australia and New Zealand. Of these A is typically a pathogen of linseed varieties, such as Punjab, and the cause of severe loss on commercial crops in the Avon Valley districts; B, C, D, and E, of which the last-named is the most virulent, attack fibre varieties such as Concurrent and Liral Crown; and G, recorded from one locality only, mainly attacks linseed varieties.

That flax rust also occurs on the wild species, *Linum marginale*, has long been known in south-eastern Australia, but it had not been recorded in Western Australia prior to the cultivation of commercial flax during the war [ibid., xxi, p. 454]. The wide distribution and perennial habit of *L. marginale* caused it to be regarded as an important potential source of *M. lini* and thus a danger to commercial crops. A survey disclosed that race A seems to be most widely distributed on wild flax and that races E and G are also found on it. The fact that four races have been recorded for the Boyup Brook area and adjacent districts where wild flax grows abundantly, suggests the likelihood that, apart from harbouring rust, *L. marginale* may play an important part in the production of new races by natural crossing.

Since 1943, 'rust-indicator' plots have been set up with a view to facilitating the discovery of new races, and to investigate more fully the distribution of those already recorded. Ottawa 770B and Argentine Selection (C.I. No. 462) have shown immunity on all sites. Uruguay 36/38 has shown high resistance throughout. Immune variants of other varieties have been noted.

Joffily (J. M.). **Cercosporiose da piteira.** [Cercosporiosis of the fibre plant.]—*Rodriguésia*, ix, 19, pp. 25–28, 4 pl., 1945. (Issued 1946.)

In 1942 *Fourcroya* [*Furcraea*] *gigantea* [Mauritius hemp] was attacked in an experimental planting in Rio de Janeiro, Brazil, by *Cercospora fourcroyae*, which was observed by Botero on *F.* sp. in Colombia for the first time in 1941 (*Caldasia*, iii, pp. 48–50, 1942). The fungus produces on both leaf surfaces sunken, circular or elliptical, scattered or confluent, light brown lesions, 5 to 15 mm. in diameter, with a dark chestnut margin; the older leaves wither from the tip downwards. The disease is most troublesome on plants up to 2½ years old. The acropleurogenous, subhyaline, obclavate, slightly curved or fusoid, usually 7- to 9-septate conidia, subtruncate at the base and tapering towards the apex, measure 40 to 110 by 5 to 6·5μ and are borne on densely fasciculate, olivaceous, simple or branched, procumbent, flexuous, sometimes geniculate, pluriseptate conidiophores, 54 to 180 by 5 to 8μ.

Stofmeel (W. S.). **De Botrytis-aantasting van Gladiolusknollen en haar bestrijding.** [The *Botrytis* infection of *Gladiolus* corms and its control.]—*Tijdschr. PlZiekt.*, xlvii, 4, pp. 154–163, 3 pl., 1941. [Received November, 1946.]

Although *Botrytis gladioli* has long been known as a pathogen of stored gladiolus corms [*R.A.M.*, xxv, p. 501] in Holland, it was not until the winter of 1937–8

that the trouble assumed an alarming form, while heavy losses were again experienced in the seasons of 1939 to 1940 and 1940–1. Corms lifted late (end of October) sustained heavier damage than those dug between mid-September and mid-October. Control may be effected by rapid drying in a warm (24° to 26·5° C.), well-ventilated barn.

HAWKER (LILIAN E.). **Diseases of the Gladiolus. III. Botrytis rot of corms and its control.**—*Ann. appl. Biol.*, xxxiii, 2, pp. 200–208, 1946.

In this third paper on diseases of gladioli [cf. *R.A.M.*, xxiv, p. 103] *Botrytis* corm rots are compared with those described by Moore [ibid., xix, p. 153]. The three types of rot associated with *Botrytis* are (1) depressed, rounded lesions, straw-coloured in the centre but deep or reddish-brown at the margin and below the tightly stretched and often cracked skin usually a cavity, (2) a spongy rot affecting the whole corm, and (3) core rot. The first type has been seen only after hot summers or in inoculated corms stored at high temperatures. It is suggested that all three rots may be different forms of the same disease.

Of 346 corms of different varieties rotting in storage during the winter of 1939–40 and examined in March, 96 were completely rotted (spongy type), 197 showed core rot spreading along the vascular strands and into the ground tissue of the corm, many being almost completely rotten, 47 had corm rot developing down from a point of infection at the scar left by the old shoot, 23 with similar rot passing up from the basal plate, and 51 had started rotting from the surface at some other point. When the old stem base could not be lifted out, leaving a clean, depressed scar, the corms often developed core rot later. This occurred frequently with the varieties Yvonne and Picardy.

Losses after planting were usually less serious than those in storage, but the early appearance of core rot in the parent corm often caused a failure of shoot emergence. It is probable that such corms carried a dormant form of the fungus when planted. *Botrytis* was isolated from young shoots or corms following premature yellowing of the new foliage. The rotting of young shoots at or below ground-level may be due to mycelium in the soil, as surface sterilization of the corms with mercuric chloride, while reducing the losses after planting failed to protect new corms from infection during the growing season. Spores from rotting shoots may be washed down by rain and so provide an alternative means of contaminating young corms, which may either be rotten at lifting or develop the disease in storage.

Numerous isolations yielded invariably similar strains of *B. cinerea* with conidia 12 to 15 by 9 to 12μ. *B. gladioli* [ibid., xxv, p. 394 and cf. preceding abstract] was not encountered. Inoculation tests showed that the proportion of infections was highest when the inoculum was inserted into wounds in corms stored under cool, moist conditions.

Of several control measures tested [ibid., xxiv, p. 373], dusting with pentachloronitrobenzene (folosan) [ibid., xxiv, p. 103] before storing gave good control, but steeping in a 0·1 per cent. solution of mercuric chloride for 20 minutes to 3 hours almost completely eliminated the infection and also controlled hard rot (*Septoria gladioli*) [loc. cit.], scab (*Bacterium marginatum*) [see next abstract], and to some extent dry rot (*Sclerotinia gladioli*) [ibid., xxiv, p. 103], although this may damage the corms.

Corms should be lifted not later than mid-October, cleaned immediately, dried rapidly, and stored in shallow trays in a dry, well-ventilated shed, protected from frost. The use of folosan dust not only protected the old corm but prevented the infection of new ones, and these effects continued into the subsequent storage period. It is also recommended that heavy, wet soils, shaded sites, and ground previously used for gladioli should be avoided.

Hawker (Lilian E.). **Diseases of the Gladiolus. IV. Note on the incidence and control of scab disease (Bacterium marginatum McCull.).**—*Ann. appl. Biol.*, xxxiii, 2, pp. 209–210, 1946.

Although Moore included scab (*Bacterium marginatum*) [*R.A.M.*, iv, p. 286; xii, p. 680] in the four principal diseases of gladiolus in Britain [ibid., xix, p. 153], observations during the seasons 1938 to 1945 show that, except during the hot summer of 1940, very little scab has occurred. In 1942 and 1943 there were, respectively, only 52 and 29 diseased corms out of 2,000 to 3,000 examined. The incidence was, therefore, too low for any data on its control to be collected from the many fungicidal experiments primarily designed to control other diseases of the same host [see preceding abstract]. Tests of fungicidal treatments during 1940 and 1941 when enough scabbed corms were available showed that mercuric chloride gave good control, but the method requires further testing on corms cleaned to growers' standards, with the husks intact. Carry-over of scab from year to year in the corms appears to be slight under field conditions, but in a heated greenhouse it is considerably higher.

Tompkins (C. M.) & Ark (P. A.). **Seedling disease of Yellow Calla, caused by Corticium solani, and its control.**—*Phytopathology*, xxxvi, 9, pp. 699–702, 1946.

A destructive seedling disease of yellow calla (*Zantedeschia elliottiana*), causing annual losses of 25 per cent. and upwards, with occasional total failures, is prevalent in commercial plantings in the Capitola–Santa Cruz section of California. Its development is promoted by warm weather, excessive humidity, poor soil drainage, the use of dirty, untreated seed, close planting, and mulching. The most conspicuous symptoms of the trouble, as observed during the last five years, are a brownish-black discoloration of the cortical tissues of the fibrous roots, both before and after emergence, usually proceeding from the tip to the crown; shrivelling and sloughing-off of the invaded tissues; foliar chlorosis, wilting, collapse, and death; and sometimes pre-germination decay of the seed.

Corticium solani was isolated consistently from infected seedlings and gave positive results in greenhouse soil inoculation tests, one strain (from Capitola) causing 25 per cent. pre- and 48 per cent. post-emergence loss and another (from Santa Cruz) 32 and 51 per cent., respectively. The minimum, optimum, and maximum temperatures for the growth of the two isolates were 7°, 25° to 28°, and 37° C., respectively. Control may be effected by thorough cleansing of the seed, dusting with spergon or some other suitable fungicide, and avoidance of the improper cultural practices mentioned above.

Ark (P. A.) & Thomas (H. Earl). **Bacterial leaf spot and bud rot of Orchids caused by Phytomonas cattleyae.**—*Phytopathology*, xxxvi, 9, pp. 695–698, 1 fig., 1946.

Considerable damage is caused in orchid houses in the San Francisco Bay region of California by an organism attacking *Phalaenopsis* and *Cattleya* spp. believed to be identical with that described by Pavarino (*R. C. Accad. Lincei*, xx, pp. 233–237, 1911) as *Bacterium* (*Phytomonas*) *cattleyae*. It is a Gram-negative, non-spore-forming rod, 2·4 by 0·4 to 0·6μ, occurring singly and in pairs, motile by means of one or two lophotrichous flagella, producing on beef extract-peptone agar (pH 6·9) at 28° C. greyish-white, iridescent, smooth, butyrous colonies with criss-cross markings like fish scales. Good growth was made in various liquid media, e.g., the synthetic carbohydrate of the Society of American Bacteriologists, Fermi's, Cohn's, and Uschinsky's. Starch is slowly digested, gelatine is not liquefied, hydrogen sulphide and indole are not produced, nitrates are reduced to nitrites.

Acid without gas is evolved in the synthetic carbohydrate medium with the addition of 1 per cent. arabinose, dextrose, dulcitol, galactose, glycerol, lactose, levulose, mannitol, sucrose, or xylose. The optimum temperature for growth ranges from 25° to 35°, and the thermal death point is 48°.

The bacterium forms on the wounded or unwounded leaves light, later dark chestnut-brown spots, coalescing to cover large areas of the surface, extending under humid conditions and at favourable temperatures to the crown, and sometimes killing the plant. Inoculations were successful on *Epidendrum o'brienianum*, *Dendrobium* sp., *Cypripedium* sp., *Phalaneopsis amabilis*, and *Vanilla*. Control may be effected by the removal of diseased plants and dabbing the lesions with a sponge soaked in 1 in 1,000 mercuric chloride.

Roodenburg (J. W. M.). **Vaat-en voetziekten in Amerikaanse Anjers.** [Vascular and foot rots in American Carnations.]—*Tijdschr. PlZiekt.*, li, 1, pp. 16–24, 1945. [Received November, 1946.]

The carnation foot rot caused by *Fusarium dianthi* is of no importance in Dutch nurseries, the author, in fact, never having observed the disease in the Aalsmeer district. On the other hand, *Phialophora* (*Verticillium*) *cinerescens* [*R.A.M.*, xix, pp. 368, 517] is responsible for severe damage and should be combated by planting in soil freed from the pathogen either by crop rotation, e.g., with tomatoes and roses, a period of two years probably sufficing, or by sterilization with steam (three hours at 80° C.) or 1 per cent. formalin (4 l. per 8 pots). The potting soil for the propagation of cuttings must also be absolutely clean. None of the varieties in local cultivation is immune from *V. cinerescens*, but some degree of resistance has been shown by Garnet Beauty, Vivian, Puritan, King Cardinal, Peter Fisher, and Bonanza.

Stevenson (J. A.). **Ferns and fungi.**—*Amer. Fern J.*, xxxv, 4, pp. 97–104, 1945.

This is a popular account of the numerous fungal parasites of outdoor and greenhouse ferns in the United States and Canada, including the rusts *Uredinopsis*, *Milesia* [*Milesina*], and *Hyalopsora*, with their alternate stages on firs (*Abies* spp.); at least ten gall- and spot-producing species of *Taphrina* [*R.A.M.*, xviii, p. 141]; the agents of tar spot, *Cryptomycina pteridis* and *Catacauma flabellum*, on bracken (*Pteridium*); *Cylindrocladium pteridis* causing a brown leaf spot of *Polystichum adiantiforme*; and three destructive pathogens of species grown for indoor decoration, i.e., *Glomerella nephrolepis* on *Nephrolepis exaltata*, *Pestalotia cibotii* on *Cibotium schiedei*, and *Alternaria* sp. on *Polypodium*.

Several ferns, especially in the south, harbour the causal organisms of serious diseases of economic crops, such as *Sclerotium rolfsii*, *Rhizoctonia* [*Corticium*] *solani*, and *Pellicularia* [*Corticium*] *koleroga* [ibid., xxii, p. 372].

Munro (Moira) & Ogilvie (L.). **Clover rot investigations.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 150–153, [? 1946].

The presence of clover rot (*Sclerotinia trifoliorum* [*R.A.M.*, xx, p. 72; xxiii, p. 24]) has been familiar in the Bristol area for many years and a large number of outbreaks are reported in some seasons. As little is known of its behaviour under the climatic conditions of south-west England, fields at Abson in south Gloucestershire and Chedzoy, Somerset, were placed under observation from 1944 to 1946, and in early March, 1945, the fungus was isolated at both places from red clover plants which showed the characteristic symptoms. A few weeks later almost all the red clover had been destroyed and widespread infection of trefoil (*Medicago lupulina*) was seen. Sclerotia were abundantly produced and large numbers of apothecia appeared in the autumn at both sites until mid-December, but no initial infection on fresh shoots was noted up to the end of

February, notwithstanding apparently favourable conditions for the infection of the plants. Ascospores germinated almost at once, even at low temperatures.

Greenhouse and field inoculation experiments begun in the autumn of 1945, using ascospore suspensions, resulted in two cases only from which *S. trifoliorum* was recovered. In October, however, when groups of apothecia-bearing sclerotia were introduced into the soil surrounding four healthy clover plants kept in moist chambers, three of the plants showed *Sclerotinia* infection by December [loc. cit.]. Further successful experimental infection followed the use of a culture of the fungus growing on a wad of sterilized clover leaves.

Tests with seed from clover-rot fields produced cultures of a fungus resembling *S. trifoliorum*. It remains to be explained why outbreaks are relatively so few, and so slow to appear in fields where ascospores are shed and under climatic conditions apparently conducive to infection.

CORMACK (M. W.). **Sclerotinia sativa, and related species, as root parasites of Alfalfa and Sweet Clover in Alberta.**—*Sci. Agric.*, xxvi, 9, pp. 448–459, 2 pl., 1946.

Further studies carried out in Alberta on the fungi associated with root rot of lucerne (*Medicago sativa* and *M. falcata*) and sweet clover (*Melilotus alba* and *M. officinalis*), particularly *Sclerotinia sativa* [*R.A.M.*, xxii, p. 27; xxiii, p. 108], showed that this fungus is sometimes very destructive to sweet clover locally in early spring but seldom attacks lucerne; it is not at present widely distributed. *S. sclerotiorum* occasionally damages lucerne and sweet clover in summer, but is more prevalent on sunflowers and vegetables. *S. minor* and *S. trifoliorum* have not yet been found on any host in Alberta.

S. sativa is a low-temperature parasite of dormant plants. It rapidly invades the roots of its hosts as the frozen soil is thawing in early spring, but its progress is arrested when host growth starts. In winter inoculation tests under field conditions it severely infected sweet clover, produced slight to moderate damage on lucerne and red clover (*Trifolium pratense*), and only slight injury on alsike clover (*T. hydridum*), while parsnip and 20 perennial wild plants were also susceptible. *S. sclerotiorum* was more virulent in summer than in early spring, and caused more damage to sweet clover than to lucerne or red and alsike clovers. *S. minor* attacked legume forage crops to about the same extent as *S. sativa*, but caused most damage in summer. *S. trifoliorum* caused more severe injury to legume forage crops and beans (*Vicia faba* and *Phaseolus vulgaris*) than any other species tested, but was not seriously damaging to any non-leguminous host except sunflower. A species of *Botrytis* of the *cinerea* type, frequently associated locally with root rot of lucerne and sweet clover, was usually only weakly virulent on all the hosts studied. Isolates of *S. sativa* from tulip bulbs were considerably more virulent to lucerne than those from legumes.

S. sativa persisted in fallowed soil and severely damaged sweet clover even after eight years, though the sclerotia rapidly decayed in moist soil. No apothecia of this or any other species studied were found under natural conditions.

In pure culture, *S. sativa* and *S. trifoliorum* grew best at 17° to 19° C., *S. minor* and *Botrytis* sp. at 20°, and *S. sclerotiorum* at about 25°. Sclerotial formation was inhibited or retarded in all species at temperatures under 10° and growth ceased at about 30°.

MENZIES (J. D.). **Witches' broom of Alfalfa in North America.**—*Phytopathology*, xxxvi, 9, pp. 762–774, 2 figs., 1946.

A comparative study of the symptomatology of the witches' broom of lucerne which is assuming a serious form in localized areas of Washington [*R.A.M.*, xxiv, pp. 151, 268; xxv, p. 385], where it was first observed in 1925, and British Columbia [ibid., xxiii, p. 3], and the disease of the same name in Australia [ibid., xiv, p. 516]

revealed no definite differences. The affected plants are stunted, with a dense proliferation of shoots from the crown, and die after one to three years from the onset of the attack. Heavy infection causes a rapid reduction in the stand. Witches' broom occurs naturally on lucerne, red and White Dutch clover, and occasionally on *Medicago lupulina* in Washington, and has been reported from Alberta on sweet clover (*Melilotus*) by M. W. Cormack in *Rep. Canad. Plant Dis. Surv.*, xx, p. 22, 1941), and W. C. Broadfoot (ibid., xxi, p. 19, 1942). At the Irrigation Branch Station, Prosser, Washington, the virus responsible for the lucerne disease was transmitted to *Medicago lupulina* and *M. hispida* by root- and shoot-grafting, and from infected to healthy lucerne plants by means of the leaf-hopper *Platymoideus acutus*, but negative results followed the use of mechanical methods, dodder (*Cuscuta campestris*), or the seed of plants suffering from witches' broom.

Ramesh Adyanthaya (N.). **A note on the occurrence of Sphacelia on Cenchrus ciliaris.**—*Curr. Sci.*, xv, 10, pp. 286–287, 2 figs., 1946.

The author observed a species of *Sphacelia* on *Cenchrus ciliaris* (a common fodder grass) at Coimbatore. The hyaline, falcate conidia had more or less pointed ends, were one-celled, with two to six conspicuous vacuoles, and measured 18·37 by 5·96μ. They germinated readily in water, producing an oval secondary conidium at the tip of the germ-tube. The grass has not previously been included in the host list of *Sphacelia* for South India [*R.A.M.*, xxv, p. 36].

Onderzoek naar de beste tijdstippen der voorjaarsbespuiting tegen Appel en Perenschurft, deel II. [Investigation on the best dates for the spring spraying against Apple and Pear scab, part II.]—*Tijdschr. PlZiekt.*, xlviii, 2, pp. 33–60, 1 pl., 2 graphs, 1942. [Received November, 1946.]

This paper incorporates the results of a four-year (1938 to 1941) investigation on the most suitable times for the spraying of apple and pear trees against scab (*Venturia inaequalis* and *V. pirina*) in Holland, part I of which has already been published [*R.A.M.*, xxii, p. 254]. The work was carried out by L. Gersons at Wageningen, B. K. Bartelds in the province of Utrecht, W. G. v. d. Kroft in South Limburg, J. D. Gerritsen in the Betuwe, B. Bosma in South Beveland, and D. Kers in the Hoeksche Waard, and is summarized by H. M. Quanjer, who instigated the inquiry.

The conidia were found to be of more importance as sources of infection in the case of pear scab than in that of apple [cf. ibid., xiv, p. 40; xxv, p. 399]. On pear branches conidia were found in wet weather before the discharge of the ascospores, which did not appear until the beginning of April. On severely infected trees the conidia of *V. inaequalis* may also precede the ascospores, but the latter play a more important part in the establishment of infection. Once the first perithecia reach maturity, from the end of March to mid-April, a shower will release the first ascospores, the forerunners of the one or more main 'flights' following further rainy spells until about 1st June, when the supply becomes exhausted.

When spray warnings are based on ascospore 'flights', wet weather may prevent the operations or the fungicide may be washed away before it has dried on the foliage. In such cases infection may take place which might have been forestalled by growers spraying according to the stage of bud development. In years such as 1938 and 1940, when the first ascospore discharge coincided with a very early stage in bud development and the main 'flight' with 'pink bud' in apples and 'white bud' in pears, the dates recommended for the two pre-blossom sprays would be approximately the same whether the criterion applied in the forecasts is ascospore discharge or bud development, and no superiority of one method over the other can be discerned. In other years, however, e.g., 1939 and 1941 in the case of apples, and the latter in that of pears, when a few weeks intervene between

the main ascospore 'flight' and blossoming, ascospore liberation is likely to afford a more reliable basis for spray warnings than bud development [see next abstract]. With late-blooming varieties, a month may elapse between bud-burst and the onset of the blossom, necessitating three applications, one to anticipate the forerunners and the others the first and succeeding 'flights' of ascospores.

Hus (P.). **Schurftbestrijding bij Appel en Peer.** [Apple and Pear scab control.]—*Tijdschr. PlZiekt.*, xlviii, 2, pp. 61–62, 1942. [Received November, 1946.]

Referring to the investigation of Quanjer and his collaborators into the method of determining the best dates for the treatment of apple and pear trees against scab (*Fusicladium*) [*Venturia inaequalis* and *V. pirina*] in Holland [see preceding abstract], the writer briefly discusses the relative merits of ascospore liberation and bud development as criteria for the issue of spray warnings. In 1941 predictions based on ascospore discharge in the Wageningen district gave more generally satisfactory results than those based on bud development. The season, however, was abnormal, the heavy precipitation and low temperatures in April and May having unduly retarded growth, so that too long an interval was left between the first and second pre-blossom sprays and the coverage was consequently insufficient to protect the buds against infection. In order to reach a definite conclusion as to the superiority of one or the other method, similar trials would have to be continued for a number of years. In the writer's opinion, growers should be guided by bud development, taking care to spray often enough to protect the trees against infection.

The following are regarded as more or less insuperable objections to using ascospore discharge as a signal for spray warnings. (1) The occurrence of ascospore 'flights' in one locality, e.g., Wageningen, does not necessarily coincide with the same process in other fruit-growing areas, where rain may fall on different dates during the critical periods in April and May. (2) At the time of ascospore dissemination unfavourable weather conditions may prevent spraying on some of the appointed days, and once infection is established it is very difficult to suppress. (3) The treatment of large areas requires some days, so that even in fine weather part of the orchard may be reached too late. (4) Under such conditions the work could not be carried out on a co-operative basis. (5) Even if difficulties were met by spraying as soon as the perithecia were mature, too long an interval might then elapse between the treatment and the discharge of the ascospores under the influence of rainfall, the exact date of which can seldom be predicted several days beforehand. (6) In mixed plantings the perithecia may ripen sooner on the leaves of one variety than of another, resulting in several ascospore 'flights' which would have to be considered in fixing the spraying dates.

Kearns (H. G. H.), Marsh (R. W.), & Martin (H.). **Experimental spraying programmes on Apples at Long Ashton : season 1945.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 132–140, 1 fig., [? 1946].

In spraying experiments against insect pests and apple scab [*Venturia inaequalis*: *R.A.M.*, xxv, p. 456] applications of fungicides in conjunction with D.D.T. emulsion or suspension on Worcester and Laxton's Superb varieties, gave the following combined mean percentages scabbed areas per leaf [computed by a method described in detail]: lime-sulphur, 0·28; copper sebacate [ibid., xxiii, p. 449], 0·63; tetramethylthiuramdisulphide [Dubay 1205–FF], 0·75; fermate, 1·23. Thus, the the first three treatments were markedly better than fermate (at 2 lb. per 100 gals.): lime-sulphur was not significantly better than sebacate (at 4 lb. per 100 gals.); or Dubay (at 2 lb. per 100 gals.).

The greatest spray damage occurred when sebacate was used with petroleum oil and the indications are that where summer oils are to be used with a fungicide,

one of these organic sulphur compounds would be preferable to lime-sulphur to minimize risk of spray damage. The scab-control figures obtained in the trials, however, indicate that these compounds are inferior in fungicidal value to lime-sulphur at the concentrations usually employed. Fermate has the further disadvantage that it leaves a tenacious and disfiguring deposit.

Holbeche (J. A.). **Boron deficiency in Apples. Observations at New England Experiment Farm.**—*Agric. Gaz. N.S.W.*, lvii, 1, pp. 17–21; 2, pp. 75–80; 3, pp. 132–136; 4, pp. 184–188, 13 figs., 1946.

The work of Savage and Broadfoot [*R.A.M.*, xvi, p. 819] on the use of borax dressings for the control of internal cork of apples [ibid., xxiii, p. 334] has been further developed in an extensive series of experiments from 1937 to 1942. It was confirmed that soil dressings were more effective and convenient than spray applications. Young, non-bearing trees should not be treated, as even small quantities of boron in the soil cause damage. Small bearing trees should receive ¼ lb., medium-sized ½ lb., and large 1 lb. borax per tree, during the months of June, July, and August [cf. ibid., xxv, p. 506]. The borax should be spread evenly on the soil in a ring 2 ft. wide, 2 to 3 ft. from the butt of the tree, and then lightly worked in. A further application should not be made until the trees begin to renew signs of boron deficiency, which is unlikely for some years and to be detected by an annual examination. Up to the present one dressing every five years appears sufficient.

Where supplies of borax are limited, or trees are only slightly affected, or if the grower has left the application of a soil dressing too late, a spray with 0·25 per cent. borax or 2½ lb. per 100 gals. water may be given. The spray should be repeated annually for two or three years, after which a year may be allowed to elapse without ill effects. Care in using the correct concentrations and methods is essential or severe damage may result.

In comparing the growth of treated and untreated trees no differences in blossoming were observed. The foliar growth of treated trees improved, their leaves were clearly of a darker green, and they did not fall until after the untreated trees were defoliated. Granny Smith fruits retained their green longer than those from untreated trees, and Jonathans were much brighter. Comparing fruit from soil-dressed apple plantations and that from sprayed trees, the fruit from the former was rather superior in appearance, texture, and flavour to that of the latter.

Of Jonathan and Granny Smith apples from soil-treated trees stored, respectively, from 2½ to 5 and 5½ to 7 months, those treated with 1 lb. borax per tree showed the lowest percentage of flesh breakdown. Maximum breakdown occurred in both varieties in fruit from plots treated with 3 or 5 lb. borax.

Applications of boron to the soil suggests their value in controlling the 'measles' condition affecting the Delicious variety of apple in some parts of New South Wales, but little improvement followed the treatment in other parts.

Apple varieties which showed no symptoms of cork over the six-year period were Milton, Stephens Seedling, Huntsman, Wallace Howard, Tates, Buncombe, and Senator, while Northern Spy and Rome Beauty were very slightly, and Delicious, London Pippin, and Crofton, slightly affected.

Leaf analyses revealed that symptoms of corking appear only when the boron content of the leaves falls below 19 p.p.m.

Florenzano (G.). **Mycosphaerella sentina (Fuck.) Schroet. Occurrence of the perithecial stage in Italy and observations relative to its biology.**—*Int. Bull. Plant Prot.*, xx, 3–4, pp. 17M–26M, 7 figs., 1946.

In April, 1943, the author observed on dead pear leaves from Pavia the perithecia of *Mycosphaerella sentina* [*R.A.M.*, xvi, p. 191; xxi, p. 403]. Additional

specimens from other provinces received in May had ripe perithecia of the latter emitting ascospores. Further work in 1944 on the development of *M. sentina* showed that the perithecial primordia appeared in mid-February and that development up to full maturity took 55 to 65 days. The first mature perithecia observed in Calabria on 7th May, 1944, began to emit spores only after 19th May, though kept under favourable moisture conditions and at temperatures not below 12° C. In 1945 the primordia were detected in mid-January, reports of mature perithecia were received by 15th April, and the emission of ascospores obtained by 5th May.

The disease caused by *M. sentina*, known locally as 'seccume fogliare estivo' or summer leaf-shrivelling, is becoming more serious every year, both in northern and southern Italy. It reduces the vitality of pear trees and their yield. The observations showed that the perfect state ensures primary infection in the spring. Preliminary laboratory tests showed that the conditions requisite for ascospore discharge are a relatively high humidity and a temperature not under 12°. These conditions usually occur in Italy (in the open) from May onwards, when primary infection of pear trees is therefore possible. Direct infection of the fruit by the conidial state, *Septoria piricola*, was observed in Calabria and Florence. Preventive treatments should be applied in the beginning of June. Further work is in progress.

Jenkins (Anna E.). **Elsinoe piri in France and Spain in the light of quarantine interceptions.**—*Mycologia*, xxxviii, 4, pp. 450–452, 1 fig., 1946.

The author records two further interceptions of *Elsinoe piri* [*R.A.M.*, xxv, p. 563] on apple fruits from Europe, one at Galveston, Texas, on 16th October, 1945, and the other at New York, on 6th January, 1945. The former consisted of two apples from Spain showing a few spots, vinaceous buff at the centre surrounded by dark mineral red, while the latter came from France, and consisted of large pieces of dried apple peel bearing numerous spots, on the larger of which the imperfect state was present in abundance, forming conspicuous, light-coloured pustules covered with a thick, dry crust of hyaline conidia. The only other record of *E. piri* from Spain was under the synonym *Melanobasidium mali* [*R.A.M.*, xi, p. 724]. Saccardo recorded the fungus from Paris as *Hadrotrichum pirinum* [loc. cit.]. Arnaud and Arnaud's *Melanobasidium* (?) on pear leaves at Chevreuse in 1930 and 1931 is certainly *E. piri*, as also is an apple fungus described in 1911 by Griffon and Maublanc. The combination *Sphaceloma pirinum* has been made by the author for the conidial stage [ibid., xxv, p. 563].

Rudolph (B. A.). **Attempts to control bacterial blights of Pear and Walnut with penicillin.**—*Phytopathology*, xxxvi, 9, pp. 717–725, 1946.

At the California Deciduous Fruit Field Station the antibiotic properties of penicillin were tested against the agents of pear and walnut blight (*Erwinia amylovora* and *Xanthomonas juglandis*, respectively) [cf. *R.A.M.*, xxvi, p. 18]. In preliminary tests in 1944 with unpurified material from an improved strain of *Penicillium notatum* (1249–b–21) [ibid., xxv, p. 353], the growth of *X. juglandis* was inhibited to a slight extent but that of *E. amylovora* was not affected. In 1945, however, the pure commercially prepared drug became available, and plate tests were conducted, in which dilutions in distilled water at the rate of 100 units per 0·1 ml. completely suppressed the development of *E. amylovora* in circular areas 25 or 35 mm. in diameter as seen under the microscope and by the naked eye, respectively. The pathogen grew normally in the presence of 10 units penicillin per 0·1 ml. *X. juglandis* was more susceptible, succumbing to a dosage of 10 units per 0·1 ml. over areas of 20 to 30 mm. in diameter, but not to 1 unit per 0·1 ml. Penicillin is bactericidal as well as bacteriostatic, no resumption of growth by the pathogens having been observed in subcultures made at frequent intervals for a fortnight from the inhibited zones. All attempts to combat either

organism by means of massive penicillin injections *in vivo* were unsuccessful, probably owing to excessive dilution of the drug by the sap of the tree trunks. In any case, the present prohibitive cost of penicillin would preclude its application in large-scale field experiments.

Phaff (H. J.), Mrak (E. M.), Allemann (Ruth), & Whelton (Rita). **Microbiology of Prunes during handling and drying. A report of a joint research project of the Quartermaster General's Office, U.S. Army, and the University of California.**—*Fruit Prod. J.*, xxv, 5, pp. 140–141, 155, 1946.

No living yeasts or moulds were found to be present on prunes [*R.A.M.*, xxv, p. 509] at the end of commercial dehydration, even though initial dipping and washing procedures not only fail to remove the contaminants but may even cause a rise in their numbers. Sun-drying also does not kill the yeasts on fresh prunes and may be responsible for a temporary increase in their incidence. Grading and handling after dehydration are further channels of recontamination, which may be extremely heavy where plant sanitation is defective.

Kapur (A. P.). **Combined spraying trials against the San José scale and Peach leaf-curl in Kashmir.**—*Bull. ent. Res.*, xxxvii, 1, pp. 29–32, 1946.

In a combined spraying experiment at Khudwani, Kashmir, in the early spring of 1944, for the control of the two most important local parasites of the peach, namely, San José scale (*Quadraspidiotus perniciosus*) and leaf curl (*Taphrina deformans*), six blocks of six 15-year-old trees were sprayed with (1) boiled soap diesel-oil emulsion, (2) Bordeaux mixture 5–5–50, followed on the fifth day by (1), (3) stock solution of (1) diluted in (2), (4) Bordeaux mixture 4–4–50–emulsified diesel oil, and (5) Bordeaux mixture 5–5–50, (6) being left untreated. The percentage of leaf curl in block (1) was 12·1, in (2) 5·1, in (3) 6·1, in (4) 5, in (5) 4·6, and in (6) 32. The best joint control of the two parasites was secured by treatment (4).

Gerritsen (J. D.). **Vragen rondom de bladvalziekte van de Roode Bes.** [Problems connected with the Red Currant leaf spot disease.]—*Tijdschr. PlZiekt.*, lii, 4, pp. 119–120, 1 fig., 1946. [English summary.]

Pseudopeziza ribis is prevalent on red currants in all parts of Holland [*R.A.M.*, xii, p. 705; xv, p. 448], assuming such a virulent form in some seasons that the bushes are defoliated by July; the resultant weakness is reflected in poor vegetative growth and a light crop. White and black currants and gooseberries are also liable to infection by the leaf spot, though less susceptible than the red varieties. Among the last-named, Fay's Prolific, Versailles, and Laxton No. 1 are very susceptible, while German Sour (Prince Albert) and Erstling aus Vierlanden are reasonably resistant. Control may be effected by spraying with Bordeaux or some other copper-containing mixture before flowering or after picking or at both times.

Besides *P. ribis*, *Mycosphaerella ribis* [*M. grossulariae*: ibid., xxv, p. 266] causes similar symptoms on the same hosts. The latter pathogen is supposed to be less widespread than the former, but exact data as to their relative distribution are lacking. The question of physiologic specialization within *P. ribis* also requires elucidation, and further trials are necessary to determine the correct dates for the application of protective fungicides to the bushes.

Bohn (G. W.) & Maloit (J. C.). **Bacterial spot of native Golden Currant (Ribes aureum).**—*J. agric. Res.*, lxxiii, 7–8, pp. 281–290, 3 figs., 1946.

The authors describe the defoliating bacterial leaf spot of golden currant (*Ribes aureum*), and the morphology, cultural characteristics, habitat, and taxonomy of the causal organism *Pseudomonas ribicola*, inoculation experiments with

which have been previously reported [*R.A.M.*, xxv, p. 349]. This is believed to be the first record of a bacterial disease of currants.

The leaf spots are usually 2 to 4 mm. in diameter, but isolated spots are frequently larger. They are round, or if near the large veins, irregular. Well-developed spots have dark brown, slightly concave centres, and reddish-brown, water-soaked, slightly raised margins, with either a narrow halo with a distinct, entire or minutely wavy edge or a broad halo with an indistinct edge. Under some conditions the margins merge into slightly raised, dark green, water-soaked areas with irregular, indistinct edges. Small veins within spots are coloured reddish-brown and shrivelled.

Infection of the young leaf causes distortion and tearing; leaves with several spots turn various shades of yellow and red with green zones remaining round the spots. Severely spotted leaves soon turn brown, dry, and drop. At Cheyenne, Wyoming, leaves developing on new shoots later in the season are usually unaffected. Spots on the stems rarely kill the shoots; fruit spots are small, raised, and brown, causing deformity, premature ripening, and some loss in yield which is probably reduced also by defoliation.

A white bacterium, obtained in apparently pure culture from all spots, was used in pathogenicity tests in the field, greenhouse, and laboratory. Six isolates were all virulently parasitic on leaves of *R. aureum* [loc. cit.], and all were recovered in pure culture from inoculated leaves and found identical with the parent cultures. The bacterium is motile and rod-shaped, occurring singly, in pairs, or in chains having cross walls difficult to distinguish even in stained mounts. The dimensions in non-flamed, nigrosin mounts varied from 0·9 to 1·7 by 0·4 to 0·9 μ. The bacterium is Gram-negative and not acid-fast. It is a facultative anaerobe, with a minimum temperature for growth less than 3·5° C., a maximum between 30° and 32·5°, and an optimum from 20 to 25°. The pH tolerance is greater than the range 5·6 to 7·5, the optimum being 7. Gelatine is liquefied slowly or not at all; milk is not coagulated but rendered more alkaline; slight acid is produced from carbohydrates.

Powell (D.). **Copper 8-quinolinolate, a promising fungicide.**—*Phytopathology*, xxxvi, 7, pp. 572–573, 1946.

In glass-slide tests 8-quinolinol [*R.A.M.*, xxv, p. 465] and its copper derivative were highly toxic to *Sclerotinia fructicola*, having an LD 50 range of less than 1·5 microgm. per sq. cm. slide [cf. ibid., xxiii, p. 35]. Chlorine substitutions on the 5 and 7 positions of these parent compounds decreased toxicity to an LD 50 of 50 and 200, and bromine substitutions to 400 and 1,200 microgm. per sq. cm., respectively. In 1945 these materials were used in field tests in Illinois for apple scab [*Venturia inaequalis*] and blotch [*Phyllosticta solitaria*] control in comparison with ½ pt. per 100 gals. water puratized N5–E (10 per cent. phenyl mercuri triethanol ammonium lactate), 1 pt. isothan Q 15 (20 per cent. lauryl isoquinoline bromide), 1 pt. isothan Q 32 (20 per cent. cetyl isoquinoline bromide), 1 lb. fermate [cf. ibid., xxv, p. 398], and 1 lb. copper 8-quinolinolate, each per 100 gals. The treatments were applied to 30-year-old Duchess trees on 27th April, 9th and 23rd May, 1st, 11th, and 22nd June, and 11th July; of these the first comprised only the several fungicides, while the rest were supplemented by 3 lb. each of lead arsenate and lime per 100 gals. water, except that lime was omitted from the fermate-containing sprays.

The fungicidal efficacy of 8-quinolinol in the laboratory was not maintained in the field, where it was, in fact, inferior to all the other compounds tested, permitting the development of 40·7 per cent. scab and 86·2 per cent. blotch, compared with 37·8 and 0·1 for fermate, 17·3 and 0·7 for copper 8-quinolinolate, 11·1 and 7·9 for puratized N5–E, 38·9 and 54 for isothan Q 15, and 42·3 and 66·1 for isothan Q 32. None of the materials tested caused injury. The copper 8-quinolinolate therefore shows considerable promise as a fungicide.

Zentmyer (G. A.) & Klotz (L. J.). **Microorganisms in Avocado tree decline.**—*Calif. Citrogr.*, xxxi, ii, pp. 436–437, 1946.

After pointing out that there have been indications recently that *Phytophthora cinnamomi* may play some part in avocado decline in California [*R.A.M.*, xxv, p. 70] the authors state that experimental evidence demonstrated that waterlogging the soil, regardless of the type of microflora present, for 10 to 14 days resulted in serious injury to seedling avocado roots, even in soil initially sterilized with chloropicrin or by autoclaving, while waterlogging in the presence of *P. cinnamomi* resulted in even worse injury and the death of the roots and tops. Duration of waterlogging was very important. When the soil was saturated for periods of two to four days, no injury resulted. When the waterlogging persisted for six to eight days injury resulted in the presence but not in the absence of *P. cinnamomi*. That soil temperature was also a factor was indicated by the fact that seedlings declined even in sterilized soil after short periods of waterlogging at 32° C.

In an experiment in the Wisconsin temperature tanks, soil inoculation with *P. cinnamomi* and the use of soil from affected areas containing *P. cinnamoni* and other micro-organisms resulted in root injury even without excess water.

At each of five soil temperatures used the seedlings in sterile soil at field [moisture-holding] capacity or less made the best growth and had the largest and healthiest roots. Using an arbitrary figure for root area, the seedlings in sterile soil at field capacity or less showed an average root area represented by 921; for sterile soil at field capacity or less inoculated with *P. cinnamomi* the figure was 222; for waterlogged sterile soil 415; for non-sterile soil at field capacity or less 223; the figures for waterlogged, non-sterile soil and inoculated soil were slightly lower. The figures for weights of roots and for increase in height followed a similar trend.

These and other results indicate that *P. cinnamomi* when present may accelerate decline, but that decline does not depend on the presence of the fungus alone. Toxic products formed by bacteria and other micro-organisms under anaerobic conditions also play a part. These include nitrite (also produced by *P. cinnamomi*), butyric acid, and hydrogen sulphide. These products, and consequently root injury and decline, increase in soils whose carbohydrate content has been increased by the addition of sugar.

Pflanzenschutzmittel zur Bekämpfung von Krankheiten und Schädlingen im Feld-, Obst-, Wein- und Gartenbau. [Plant-protectives for the control of diseases and pests in agriculture, fruit-growing, viticulture, and horticulture.]—29 pp., Eidgenössische Versuchsanstalt für Obst-, Wein- und Gartenbau, Wädenswil, Zürich, 1944. [Received December, 1946.]

This pamphlet falls into two parts, of which the first deals with plant-protectives for the control in Switzerland of diseases and pests of (*a*) field crops and (*b*) fruit trees, vines, and horticultural plants, while the second furnishes lists of (*a*) authorized plant-protectives, arranged in groups according to their active ingredients, (*b*) the names and addresses of the firms supplying them, and (*c*) the same preparations in alphabetical order.

Pflanzenschutzmittel-Verzeichnis 1946. Mittel gegen Pflanzenkrankheiten, Schädlinge und Unkräuter im Feld-, Obst-, Wein- und Gartenbau. Offizielle Liste der bewilligten Kontrollmittel 1946. [List of plant protectives 1946. Remedies against plant diseases, pests, and weeds in agriculture, fruit-growing, viticulture, and horticulture.]—36 pp., Eidgenössische Versuchsanstalt für Obst-, Wein- und Gartenbau, Wädenswil, Zürich, 1946. [French translation.]

The plant-protectives officially sanctioned for the control of plant diseases and pests in Switzerland are listed (*a*) in groups according to their active ingredients,

with indications as to their several purposes and the names of the manufacturers, and (*b*) in alphabetical order.

Brues (C. T.). **Insect dietary.**—x—466 pp., 22 pl., 68 figs., Cambridge, Massachusetts, Harvard University Press (London, Geoffrey Cumberlege, Oxford University Press), 1946. 28*s*.

In this book, the Professor of Entomology at Harvard University gives a full account of the relationship between insects and their environment through the medium of their food, showing how their search for food has affected their development and that of numerous animals and plants. The work is divided into ten chapters (each accompanied by an extensive and valuable bibliography) dealing, respectively, with the abundance and diversity of insects, types of food habits, herbivorous insects, gall insects, fungi and microbes as food and symbiosis, predatory insects, parasitism, blood-sucking insects and other external parasites, entomophagous and other internal parasites, and, finally, insects as food for man and other organisms. There are interesting references (p. 193 *et seq.*) to fungi as food for certain insects, e.g., yeasts, *Mucor*, and *Penicillium* spp. and (p. 206 *et seq.*) an account of commensal associations between insects and fungi, e.g., between the scale insect *Aspidiotus osborni* and *Septobasidium retiforme*. Fungal diseases of insects also receive mention (p. 412 *et seq.*).

Moore (W. C.). **Seed-borne diseases.**—*Ann. appl. Biol.*, xxxiii, 2, pp. 228–231, 1946.

The dangers associated with the uncontrolled movement of diseased seed were unquestionably increased by war-time problems of seed supply. Before the war no international standard existed for the certification of seed for export as free from disease or for preventing its entry unless so certified. Some governments, including the British, allowed unrestricted entry of seeds; others required certificates of health for certain specified seeds or for all; and a few had special regulations. South American countries required certificates for all seeds; the United States only for those of trees, shrubs, and sweet peas; and the Dutch East Indies for all seeds not included in a long free list.

When a certificate is required by an importing country for British seed it is sampled by inspectors of the Ministry of Agriculture, and tested at the Plant Pathological Laboratory, Harpenden. If it passes the tests, the stocks from which samples were taken can be drawn upon without further testing; rejection entails that of the whole stock. Approved seed then qualifies for the Ministry of Agriculture's certificate stating that on a certain date it was 'found, or believed to be, free from injurious plant diseases and dangerous insect pests'. Between 1925 and 1943 nearly 30,000 such samples were examined at Harpenden, and of these the great majority were flower seeds, the rest mainly vegetables, with a few cereals; 650 were rejected on the ground that they carried parasitic organisms. These mostly consisted of peas, celery, and parsley, 27 per cent. of the peas being infested by *Ascochyta* spp. [*A. pisi* and *A. pinodella*], or showing symptoms of marsh spot [manganese deficiency]; 42 per cent. of the celery with *Septoria* [*S. apii-graveolentis* and *S. apii*], and 31 per cent. of the parsley with *S. petroselini*.

The number of seed samples received for certification dropped almost to zero during the war. It was, however, necessary to watch carefully for new diseases which might have entered the country on or in imported seed. Bacterial canker of tomato (*Corynebacterium michiganense*) [*R.A.M.*, xxiii, p. 193], a disease primarily seed-borne and first recognized in Britain in 1942, was the cause of 10 outbreaks in 1943. Six of these were traced to the same source of seed, imported from a country where the disease was well known. Further distribution of seed was prevented by official action and the outbreaks effectively checked. Although

the disease did not reappear in the infected nurseries, the number of fresh cases reported elsewhere by November, 1945, had reached 31. Under glass there appears to have been little damage to the crops, but in 10 of the 26 field outbreaks loss was moderate to severe. It does not follow, however, that all the outbreaks of *C. michiganense* began in this way and the disease may have been present here to some extent under glass before the war.

Seed-testing is not regarded as in itself a particularly effective method of controlling seed-borne diseases, in view of the large number of seed-borne parasites and the many ways in which they can be carried, often impossible to detect merely by examining or even germinating the seed. If the problem is to be tackled seriously, more information is needed concerning the extent to which diseases, especially those of vegetables and flowers, are seed-transmitted, the morphology and biology of seed infection, the behaviour of the pathogens during seed dormancy, and the factors underlying the often baffling occurrence and appearance of a disease in crops raised from infected seed.

Certification of healthy seed crops in the field seems at present to offer the only solution for obtaining stocks free from viruses and those bacterial and fungal diseases which are carried internally in the seed. Even so, there may be ample opportunity for subsequent infection to occur during harvesting or threshing or in store. Thus, different avenues of approach must be regarded not as alternatives, but as mutually complementary. An ideal might well be field inspection and certification, followed by scientific harvesting and handling and, if necessary, seed treatment, and finally by seed-testing in which just as much importance is attached to freedom from disease as to purity and vitality.

Proceedings of the Association of Applied Biologists.—*Ann. appl. Biol.*, xxxiii, 2, pp. 231–244, 1946.

At the Annual General Meeting of the Association of Applied Biologists, 1946, the official scheme for the approval of proprietary products for the control of plant pests and diseases was discussed.

In the first paper H. Martin reviewed past attempts to establish such a scheme, the difficulties encountered, and the steps taken officially, which have resulted in the Ministry of Agriculture putting the present voluntary scheme into operation in October, 1942 [*R.A.M.*, xxii, p. 71].

J. T. Martin described the provisions and administration of the scheme. It is concerned only with those preparations (not of secret composition) usually available in Great Britain for the control of pests and diseases of growing crops, and is open to all British manufacturers and to foreign firms with agents resident in the country. An approval mark guarantees the products under the conditions of the scheme and lists of approved products are issued periodically [ibid., xxiii, p. 237]. The basis of approval of products is the conformity to an accepted specification or the evidence of efficiency; certificates of approval valid for one year are issued and may be renewed annually. So far 180 products in 18 groups have been approved. The scheme, which provides guidance to the purchaser of insecticides and fungicides without legislation or testing of the products, should eventually become fully established.

Speaking as a manufacturer, J. R. Booer summed up the advantages and disadvantages from his point of view. He said that the scheme had improved the liaison between the Ministry, the advisory officers, and the manufacturers. He thought, however, that it would not attain its full value until there was available an approved product against every insect pest and fungus disease with which growers have to contend, and controllable by chemical means.

W. A. R. Dillon Weston, as a specialist advisory officer, showed how the scheme worked for organo-mercury seed dressings, of which eight have been

approved [ibid., xxii, p. 128; xxiii, p. 434, *et passim*]. He suggested that for the guidance of the grower the percentage composition of each should be disclosed, and that it might be advisable to approve such dressings only after field tests had demonstrated that they controlled seed-borne diseases adequately.

O. G. Dorey, representing the growers, deplored the lack of publicity for the scheme and the approval of products without independent or official analysis.

Staniland (L. N.). **Simple laboratory and field apparatus for the production of accurate line drawings to scale.**—*Ann. appl. Biol.*, xxxiii, 2, pp. 170–177, 6 figs., 1 graph, 2 diags., 1946.

An apparatus is described with which accurate scale drawings of developmental changes in plants or other biological material can be made. A vertical sheet of clear glass is set up with a pin-hole 'peep-sight' on one side and the object to be drawn on the other. The object viewed through the sight can be outlined accurately with pen and Indian ink on the glass surface. The use of the sight eliminates parallax effects. The apparatus can be used in conjunction with a lens where magnification is required.

Turner (J. S.), McLennan (E. I.), Rogers (J. S.), & Matthaei (E.). **Tropic-proofing of optical instruments by a fungicide.**—*Nature, Lond.*, clviii, 4014, pp. 469–473, 3 figs., 1946.

Problems presented by the liability of optical instruments to fungal attack during military operations in New Guinea [*R.A.M.*, xxiv, p. 379; xxv, p. 515], where the warm and humid conditions are ideal for the development of fungus infection, led to an investigation by a sub-committee of the Australian Scientific Instrument and Optical Panel. *Penicillium spinulosum*, *P. commune*, *P. citrinum*, *Aspergillus niger*, *Trichoderma viride*, *Mucor racemosus*, and *M. ramannianus* were frequently isolated from instruments supplied to New Guinea. An etched pattern may appear on the glass if the mycelium remains for several months in contact with it. Usually, on removal, the mycelium leaves only a slight stain resembling an oil film. This can be erased by cerium oxide polishing.

It was decided that a volatile fungicide suitable for introduction into the instrument during its first re-servicing and fitting with graticules should fulfil the following requirements: toxicity to all possible contaminants; action at a distance (volatility), as the substance cannot be placed directly on the optics; stability in moist air and up to a temperature of 60° C.; persistence of action over several months or years; inability to corrode metals; non-toxicity to man; repellence to mites; and availability in war-time. Inability to satisfy one or both of the first two foregoing requirements when incorporated in luting wax and tested against mixed spores led to the rejection of a number of fungicides, of which only thymol was at all promising.

Acting upon a suggestion by V. M. Trikojus, it was found that sodium ethylmercurithiosalicylate, used by the Australian Army Medical Corps for preserving blood and referred to as 'M.T.S.' [merthiolate: cf. ibid., xix, p. 275], completely suppressed all the fungi concerned. Dry merthiolate is scarcely volatile, but in the presence of water vapour it undergoes decomposition, to give a very active fungicidal and fungistatic vapour. Subsequently it was mixed with black lacquer to give a concentration of 0·2 per cent. in the liquid and used to cover the interior metal surfaces of optical instruments; it was also incorporated in the microcrystalline wax used for luting purposes.

The butyl and methyl esters of merthiolate were less satisfactory in the Australian experiments, but Hutchinson found the butyl ester more effective in the Panama zone than merthiolate itself, and this ester, in view of its solubility in lipoid solvents, may supersede eventually the sodium salt.

Used in aqueous solutions, merthiolate causes rapid corrosion of aluminium and slight corrosion of brass, but when incorporated in a suitable lacquer (nitrocellulose is recommended) the metal is fully protected. As a precaution against corrosion, merthiolate has also been incorporated into the zinc-oxide-retinax grease used as a lubricant. Several thousand optical instruments have now been tropic-proofed and no report of corrosion has been received from the Services.

In 1944, 350 badly sealed United States aircraft cameras were reported as being severely damaged by fungal attack. After treatment with fungicidal lacquer no further attacks occurred. The internal painting of the fibre camera cases inhibited fungal growth within them. The Royal Air Force are testing merthiolate in Britain, where it is recommended that the internal metal surfaces should be anodized or covered with a primer before the treated lacquer is applied.

Another suggested use of merthiolate is against mould-spotting of framed prints, and it may repay investigation by technical officers in museums and galleries.

Emerson (R. L.), Whiffen (Alma J.), Bohonos (N.), & De Boer (C.). **Studies on the production of antibiotics by Actinomycetes and molds.**—*J. Bact.*, lii, 3, pp. 357–366, 2 graphs, 1946.

From 239 United States soil samples, 221 cultures of moulds and 1,007 of Actinomycetes were tested by the streak plate method against a number of bacteria and fungi pathogenic to man. Some 50 per cent. of the cultures produced inhibitory substances, and 37 moulds and 107 Actinomycetes showing promise in the first series of tests were studied further in shaker flasks for their action on *Escherichia* [*Bacterium*] *coli* and *Staphylococcus albus*, while 58 Actinomycetes and 35 moulds were used in experiments with *Cryptococcus hominis* [*C. neoformans*]. Ten moulds and 80 Actinomycetes produced culture fluids inhibiting the growth of *Bact. coli*, the corresponding figures for activity in respect of *S. albus* being 13 and 101, respectively. The development of *C. hominis* was arrested by the culture liquids of all but one of the 58 Actinomycetes tested, and by all but two of the 35 moulds.

Carvajal (F.). **Studies on the structure of Streptomyces griseus.**—*Mycologia*, xxxviii, 5, pp. 587–595, 3 figs., 1946.

An account is given of studies made by the author with light and electron microscopes on the structure of active and inactive strains of *Streptomyces griseus* [see next abstracts] and other Actinomycetes. The observations on *S. griseus* deal with the mycelium, spore formation, spore germination, and the nucleus. The spores may be oval, spherical, cylindrical, or bean- or barrel-shaped, and are borne exogenously in chains on the aerial mycelium. They usually germinate at one or both ends.

Carvajal (F.). **Biologic strains of Streptomyces griseus.**—*Mycologia*, xxxviii, 5, pp. 596–607, 4 figs., 1946.

Only a few strains of *Streptomyces griseus* (formerly referred to as *Actinomyces griseus* [*R.A.M.*, xxiv, pp. 165, 426]) isolated from soil, river mud, insects, plant roots, air, foodstuffs, animal excreta, decomposing plant material, and dust were found to produce streptomycin [ibid., xxv, p. 308], and these varied greatly in their ability to do so. When *S. griseus* strains were streaked at the same time perpendicularly to bacterial testers they were partially inhibited by *Staphylococcus aureus*, *Bacillus subtilis*, and *E*[*scherichia*: *Bacterium*] *coli*. Colony variation occurred among colonies derived from the same isolate. The stability of the cultures was improved by smearing the whole surface of the medium with a heavy suspension of spores. Lyophilized cultures of active strains of *Streptomyces griseus* did not differ from the parent cultures in morphological, physiological, or biochemical characters.

Waksman (S. A.), Reilly (H. Christine), & Johnstone (D. B.). **Isolation of streptomycin-producing strains of Streptomyces griseus.**—*J. Bact.*, lii, 3, pp. 393–397, 1946.

From the results of a study at the New Jersey Agricultural Experiment Station of eight strains of *Streptomyces griseus* [see preceding abstracts] it was concluded that not all are capable of producing streptomycin [*R.A.M.*, xxvi, p. 18]; streptomycin-producing strains form active and inactive variants, the latter comprising two types, one free from aerial mycelium and the other developing a pink tinge in the vegetative growth, the aerial mycelium being typical of *S. griseus*; a medium enriched with streptomycin can be used for the isolation of fresh strains of the organism from natural substrata and also for the purification of active from inactive variants.

Gause (G. F.). **Litmocidin, a new antibiotic substance produced by Proactinomyces cyaneus.**—*J. Bact.*, li, 6, pp. 649–653, 1946.

An actinomycete named *Proactinomyces cyaneus* var. *antibioticus*, isolated from south Russian soil, was found to produce a substance, designated litmocidin, which exerts a powerful bacteriostatic action on *Staphylococcus aureus*, *Streptococcus haemolyticus*, *Vibrio comma*, and *Mycobacterium tuberculosis* in the presence of blood serum. It did not, however, prevent the development in mice of septicaemia caused by a strain of *Staphylococcus* very susceptible to litmocidin *in vitro*.

Brazhnikova (Mme M. G.). **The isolation, purification, and properties of litmocidin.**—*J. Bact.*, li, 6, pp. 655–657, 1946.

Litmocidin, the new antibiotic produced by *Proactinomyces cyaneus* var. *antibioticus* [see preceding abstract], has been isolated and purified. It was found to possess a constant melting-point at 144° to 146° C. It is a pigment, having many features in common with plant anthocyanins, and can be obtained in two forms, one acid (red) and the other alkaline (blue), with different solubilities in water. Both forms inhibit the growth of *Staphylococcus aureus* in a dilution of 1 in 4,000,000.

McAulay (A. L.), Plomley (N. J. B.), & Ford (J[oan] M.). **Saltants produced in the fungus Chaetomium globosum by monochromatic ultra-violet irradiation and a growth effect characteristic of wavelength.**—*Aust. J. exp. Biol. med. Sci.*, xxiii, 1, pp. 53–57, 2 figs., 1945.

Saltations involving modifications of the growth-rate and form, mycelium, and perithecia of *Chaetomium globosum*, as well as an alteration in the growth-type, designated 'K', have been induced by monochromatic ultra-violet irradiation. The mycelium produced by the irradiated spores frequently shows instability and a capacity for development into more than one colony type, this feature being particularly marked in the 'K' sectors. For equal lethal effects of the irradiation the production of 'K' sectors amounts to 31·3 per cent. at 265 mμ, but less than 5 per cent. at 313 and 334 mμ, whereas saltant production is independent of wave-length.

Ford (Joan M.). **Morphological, inheritance and growth studies of the K saltation produced selectively by short wavelengths of ultra-violet irradiation in the fungus Chaetomium globosum Kunze (Ascomycetes, Sphaeriales).**—*Aust. J. exp. Biol. med. Sci.*, xxiv, 3, pp. 241–250, 5 figs., 3 graphs, 1946.

Distinctive features of the 'K' growth-type modification induced in *Chaetomium globosum* by short-wave ultra-violet irradiation [see preceding abstract] include arrested development at the edge of the colony, the production of a brown pigment

insoluble in water, ether, alcohol, and xylol, belated 'flares' of surface and aerial mycelium, and the formation outside the brown zone of white knots of mycelium, which subsequently give rise to numerous perithecia. As many as six 'K' sectors (another three are reported in a footnote) alternating with normal ones have been observed in one colony developing from an irradiated spore. The 'K' instability can always be reproduced from certain areas of the mycelium, and in a number of cases has been carried through several generations of spore subcultures. It is now thought justifiable to designate this instability as a saltant change.

NEWTON (W.). **The growth of Sclerotinia sclerotiorum and Alternaria solani in simple nutrient solutions.**—*Sci. Agric.*, xxvi, 7, pp. 303–304, 1946.

This study of the growth of *Sclerotinia sclerotiorum* and *Alternaria solani* in simple nutrient solutions was undertaken to establish a standard nutrient solution that contained only essential basic constituents. The experiment was based on a simple mineral-dextrose solution, consisting of a mixture of potassium hydrophosphate, potassium nitrate, and dextrose, no measurable growth being obtained when the sugar or any of the constituent ions of these compounds was omitted. When *S. sclerotiorum* and *A. solani* were grown in this basic medium the dry weights of the mycelia progressively increased with the successive additions of the ions magnesium, sulphate, and calcium. The replacement of nitrate by ammonium considerably inhibited the growth of *A. solani*. Although inferior to nitrate, asparagin was a good source of nitrogen for both fungi.

Plant diseases. Notes contributed by the Biological Branch. Armillaria control. Squirter and black-end disease of Bananas.—*Agric. Gaz. N.S.W.*, lvii, 4, pp. 177–180, 6 figs., 1946.

It has been found possible to kill *Armillaria mellea* infecting the roots of citrus trees by removing the soil to expose the roots, thus causing the fungus to dry out. Infected trees can be maintained in production for years after this treatment and subsequent manuring and careful attention. The rapid removal of the soil from the crown roots and base of the trunk has been accomplished by means of a jet of compressed air, applied by a pneumatic drill air-compressor through two 60-ft. hoses, each with a 6-ft. rod equipped with a pistol-grip shut-off. The soil is blown away in short blasts, this being more effective in action owing to the build-up of pressure, and more economical in petrol consumption, than a continuous jet. Sixteen trees (or thirty planted 24×12 ft.) can be treated from one position, and experienced workers can clear dry, infested soil from about 150 trees a day, or from about 80 in wet soil. Hire of the machine from the Erina Shire Council, with the maintenance engineer, costs 30*s.* per day; petrol consumption varies, according to soil conditions and the operator's skill, from 6 to 12 gals. per day. In any case it is more economical than if done by hand, is less laborious, is speedier, and entails no damage to the roots. It is probably efficacious only for light soils but these are the only ones where pathogenic activity is serious.

The causes and symptoms of squirter disease of bananas (*Nigrospora sphaerica*) and black-end (*N. sphaerica*, *Gloeosporium musarum*, and *Fusarium* spp.) [*R.A.M.*, xxi, p. 31] are described, together with control measures.

Scottish Society for Research in Plant Breeding. Report (abridged) by the Directors and Report of the Director of Research to the Annual Meeting, 18th July, 1946.—41 pp., 1946.

Included in this report of the Director of Research [cf. *R.A.M.*, xxii, p. 447] are the following items of phytopathological interest. W. BLACK and J. C. HAIGH (p. 12) report that a necrotic reaction to potato virus Y has been found in certain wild potato species from Mexico and Central America, on which breeding work is

now in progress, and additional material has been obtained which may assist the production of varieties resistant to this virus.

G. Cockerham and T. M. R. M'Ghee (p. 17) have studied the hypersensitive reactions of E.P.C. 4 (a variety of *Solanum demissum*), *S. simplicifolium*, and their seedling progenies towards potato virus Y and have shown that this character has in all probability the value of field immunity, at least in older plants, although in newly emerged plants several lethal systemic infections followed the feeding of infectious aphids. The progeny tests suggest that the character is hereditary, although the actual mode of inheritance is not yet clear [ibid., xxv, p. 228].

Investigations were carried out on the effect of virus Y on seedling progenies of varieties which show leaf-drop streak when infected with this virus and which are killed, and therefore field-immune, when infected with the C strain of virus Y [ibid., xxiii, p. 404]. The results indicate that the two reactions are probably related, and that field immunity from virus Y might be secured by replication of the gene conditioning field immunity from strain C through selective breeding within the range of the cultivated varieties.

Vasudeva (R. S.) & Lal (T. B.). **Studies on the virus diseases of Potatoes in India. II. Solanum virus 2 (Orton).**—*Indian J. agric. Sci.*, xv, 5, pp. 240–242, 2 pl., 1945.

Continuing their studies on potato virus diseases in India [*R.A.M.*, xxiv, p. 334; and cf. xxvi, p. 45] the authors isolated in a pure form *Solanum* virus 2 (potato virus Y) from Phulwa potato plants showing either negligible mosaic and veinal necroses or severe mosaic only. The varieties Gola, Majestic, President, Windsor Castle, and Talisman (Up-to-Date) showing the same symptoms followed by acropetal necrosis and all the Phulwa plants except a few, showing negligible mosaic and veinal necroses, gave a mixture of potato virus Y and *Solanum* virus 1 [potato virus X]. Virus Y was isolated by passage of the complex through *Petunia hybrida*. The symptoms shown by plants of some of the varieties from which virus Y was isolated are described, as are all the reactions of the pure isolate on certain differential plants (Harrison's Special and White Burley tobacco, *Nicotiana glutinosa*, *N. sylvestris*, *N. rustica*, *Datura stramonium*, *Solanum nodiflorum*, *P. hybrida*, and President potato). The virus rapidly lost activity after exposure to 50° C., and at 54° it became innocuous. It was inactivated also by dilution to 1 : 1,000 and by storage (of standard extract) for 24 hours at room temperature. It was held back during passage through Chamberland filters (L to L 5).

Milbrath (J. A.). **Green dwarf : a virus disease of Potato.**—*Phytopathology*, xxxvi, 8, pp. 671–674, 2 figs., 1946.

Green dwarf, a disease of potatoes hitherto undescribed, and not yet a source of serious loss, has been known in Oregon for several years. It is caused by a virus apparently distinct from other potato viruses and as it is often found in fields set apart for tuber production, it is probable that the disease has a wider, but unrecognized, distribution. Green dwarf, tuber-perpetuated, has been found in fields of Netted Gem potatoes grown from Montana seed.

The characteristic symptoms are late emergence and severe dwarfing. A mature plant may attain a height of only 6 in. The apparently normal basal leaves are bunched in a rosette of four or five leaves. The terminal growth is dwarfed and distorted, and the growing point constricted into a cluster of small leaves. Upward cupping of the young leaves occurs. The plants may be rather darker than normal; the tubers are small but show no other symptoms.

In the greenhouse the symptoms differ considerably from those of field-grown plants. Emergence is one to two weeks late, a dark, leafy bud develops slowly, and the older leaves spread into small structures, of a uniform dark green, often

only 1 to 2 in. long. The plants are very stiff and erect, and the growing point remains compact or constricted. Green Mountain plants, from tubers inoculated the previous year with the virus, after two months' growth, produced blossom clusters on 6-in. high plants, with a leaf-spread not more than 2 in. The White Rose variety and some others, after late emergence and slow development, produced fairly normal plants 12 to 18 in. tall. Natural infection in the field causes only local dwarfing in the terminal region during the current season's growth.

The disease has been readily transmitted in five varieties by stem-grafting.

The virus seems to pass slowly through the host, as tubers from newly infected plants may not all produce diseased plants, and tubers cut in pieces and planted as a unit may give only one green-dwarf plant per unit. Although most fields show only 1 per cent. disease, the considerable spread noted during the 1945 season gave much concern to growers of certified seed in those areas.

Samuel (G. G.). **Some precautions for Potato clamping.**—*J. Minist. Agric.*, liii, 7, pp. 312–313, 1946.

During 1946 potato blight [*Phytophthora infestans*] appeared in June both in Lincolnshire and south-western England. The continued wet weather in July and August favoured a slow, steady spread of infection, and the lack of warmth retarded the destruction of the haulms. A long sporulating period resulted and heavy rains caused much tuber infection. Haulm destruction by chemical spraying was consequently too late in many fields.

Care must be taken when building clamps to ensure that affected tubers are kept out, and tubers should go into the clamps dry. When wet clamping is unavoidable they can often be dried fairly well during the sweating period. If the tubers are well covered with straw held in place by soil, the rise in temperature during sweating, together with effective ventilation, will help to dry them during the two or three weeks before they are earthed-up, when wet straw should be replaced by dry. If the tubers are wet when clamped, the size of the clamp should be reduced and it should be well ventilated at the top and base.

An epidemic of wet rots in seed potatoes in 1945 was found to have been due largely to insufficient allowance being made for the normal rise in temperature of newly lifted potatoes, ventilation being inadequate in trucks, in clamps that were closed too soon, and in heaps in permanent stores. If clean tubers, free from disease, are clamped in dry conditions, allowed to sweat properly before earthing-up, in a well-constructed, rain-proof clamp before the onset of the first serious frosts, storage troubles seldom occur.

Eddins (A. H.), Proctor (E. Q.), & West (E.). **Corky ringspot of Potatoes in Florida.**—*Amer. Potato J.*, xxiii, 9, pp. 330–333, 1 fig., 1946.

Corky ring spot of potato tubers, known as spraing in England [cf. *R.A.M.*, xxiii, p. 40], was observed at Hastings, Florida, for the first time in crops harvested from three farms during April, 1946. The fields in which it occurred had a fine, sandy soil and had been used for potato-growing for more than 25 consecutive years, or, in one case, for cabbages for several years. The symptoms consisted of brown, concentric rings or sections of rings on the surface of the tubers. There was much cracking of the skin in the rings. Some tubers also showed growth cracks and shallow, irregular, corky depressions. The flesh beneath the surface rings in the affected parts was brown and showed the same ring-like patterns, the discoloration resembling that due to late blight [*Phytophthora infestans*] and sometimes becoming apparent on the surface. In severe cases, brown, corky areas and brown masses of starch grains were scattered throughout the flesh. No organism was obtained on potato dextrose agar from affected material. The authors con-

clude that corky ring spot is different from physiological internal necrosis [ibid., xxv, p. 275].

Van Beekom (C. W. C.). **Rhizoctonia ziekte in Aardappelen en bemesting.** [*Rhizoctonia* disease in Potatoes and manuring.]—*Tijdschr. PlZiekt.*, li, 3, pp. 82–84, 1945.

Following up Quanjer's researches on the relation of manuring to the *Rhizoctonia* disease of potato [*Corticium solani*: *R.A.M.*, xxv, p. 228], the writer conducted an experiment with Eigenheimers in a field of reclaimed sand in south Holland to determine the effect of potash on the incidence of infection. In the autumn of 1942, after the application of the fertilizer in two consecutive years, the potash values for the plots of 0·36 are each [1 are = 100 sq. m.] receiving dosages of 100, 150, 200, and 250 kg. per ha. ranged from 34 to 46, compared with 22 for the untreated. In the spring of 1943 the same amendments were given, with the addition of nitrogen at the rate of 500 kg. per ha. before planting the potato crop. The number of diseased plants in the treated plots ranged from 10 to 15 compared with 66 in the control, clearly demonstrating the increase in susceptibility to *C. solani* consequent on the omission of potash from the fertilizer.

Blodgett (F. M.) & Stevenson (F. J.). **The new scab-resistant Potatoes, Ontario, Seneca, and Cayuga.**—*Amer. Potato J.*, xxiii, 9, pp. 315–329, 1946.

Descriptions are given of three scab [*Actinomyces scabies*] -resistant potato seedlings which have been tested in New York State from 1938 to 1944, inclusive. They are not at present recommended unreservedly, but may prove temporarily useful in localities where the disease is troublesome. Ontario, a late-maturing variety, gave the biggest yields; it is highly resistant to scab, and possesses some resistance to late blight [*Phytophthora infestans*] and wilt (*Fusarium solani* var. *eumartii*); its cooking quality is fair to good. Ontario (528–242) is a selection from the cross between Richter's Jubel and U.S.D.A. 44537 [*R.A.M.*, xxii, p. 175]. Cayuga was comparable in yield with Rural and Sebago. It produced a rather lower percentage of No. 1-size potatoes than the other scab-resistant seedling varieties or standard varieties (about 85, as compared with 90 per cent.), but is highly scab-resistant and shows some resistance to late blight and wilt. It appears to have the best cooking quality of the three. Seneca was lowest in total yield, but gave a higher percentage of No. 1 potatoes than Cayuga. It showed some resistance to late blight and wilt, but less resistance to wilt than Ontario. Seneca and Cayuga were both derived from the cross Hindenburg × Katahdin.

Steinmetz (F. H.). **The incidence of common scab on Green Mountain Potatoes in soils at different pH levels.**—Abs. in *Phytopathology*, xxxvi, 8, p. 682, 1946.

A field which had lain fallow for several years was divided into plots the soil of which was so amended with lime (calcium carbonate) and finely divided sulphur as to give the following pH levels per plot: 4·5, 5, 5·5, 6, and 6·5, the amounts added in lb. per acre being, respectively, 2,000 (sulphur), 1,000 (sulphur), 0, 2,000 (lime), and 4,000 (lime). One series of these treated plots received 600 lb. sulphur per acre. All these amendments were applied once in the spring just before planting the first Green Mountain potato crop [*R.A.M.*, xxv, p. 78]. The crop failed the first year on the plots which had received 2,000 lb. sulphur, and was suppressed on those which had had 1,000 lb. All plots were free from scab [*Actinomyces scabies*]. After the second potato crop the suppressing effects of the sulphur were not marked. Those plots which received 600 lb. sulphur produced good yields without scab each year. After 10 years the increase in scab was in direct relation

to the increase in the pH level above 5·5. At present the plots with the original pH levels adjusted to 6·0 and 6·5 produce non-marketable scabby potatoes.

Mol (J.) & Ormel (H. A.). **Enkele opmerkingen over poederschurft Spongospora subterranea Wallr.** [Some observations on powdery scab *Spongospora subterranea* Wallr.]—*Tijdschr. PlZiekt.*, lii, 1, pp. 18–22, 2 pl., 1946.

A severe outbreak of powdery scab of potatoes (*Spongospora subterranea*), hitherto reported from Holland [*R.A.M.*, vi, p. 462] only in an innocuous form, occurred at Overijssel and Drenthe in 1943 on the Bintje and Geelblom varieties. In some fields over 50 per cent. of the tubers were infected, and the rot increased substantially during storage, so that by the following spring extensive decay had set in. *Fusarium* spp. predominated in the isolations from the sunken, pale- to dark-coloured rings, 5 to 7 mm. or more in diameter, surrounding the powdery scab spots proper in a large batch of Bintje tubers.

The diagnosis of powdery scab is facilitated by the development of spore balls between the cork layers [ibid., ix, p. 264]. In some of the tubers examined these structures had not yet appeared by the middle of October, whereas sections through others from the same consignment disclosed as many as eighty.

Otis (C. E.). **The killing of Potato tops with chemicals in Oregon.**—*Amer. Potato J.*, xxiii, 9, pp. 333–336, 1946.

After briefly reviewing the reasons for killing potato haulms with chemicals before they mature [cf. *R.A.M.*, xxiii, p. 452] and the factors that affect rapidity of killing, the author states that dust applications are not recommended for eastern Oregon because of the low atmospheric humidity that prevails locally. For other areas, of three dusts found to be effective, copper sulphate (40 to 50 lb. per acre) was the slowest and least satisfactory, but it will kill if the prevailing conditions are warm and humid. Calcium cyanamide (40 to 50 lb. per acre) is effective when used in favourable climatic conditions. Sinox (15 per cent., 30 to 35 lb. per acre) [ibid., xxiv, p. 113] was the most phytocidal of the dusts tested, but its effect also depends on humidity and temperature. Of the sprays tried, ammonium thiocyanate (40 to 50 lb. per acre in solution) has a fertilizing effect. Used as a spray, copper sulphate should be applied at the rate of 40 to 50 lb. per acre, with enough water added to give good leaf coverage. Sinox General, containing one of the dinitro compounds plus an emulsifier, and used at 1 to 1½ q. or more plus 2 or more gals. stove or diesel oil per 100 gals. water, has given good results. Another effective mixture is Dow Contact Herbicide, used at the rate of 1½ to 2 or more gals. per 100 gals. water with additional oil if desired.

Large (E. C.), Blenkinsop (A.), & Le Riche (H. H.). **Potato leaf scorch.**—*J. Minist. Agric.*, liii, 5, pp. 211–216, 1 pl. (facing p. 209), 1946.

Almost all the potatoes, both early and late varieties, grown in Devon and Cornwall show a condition of the foliage due to potash deficiency and known to growers as 'rust' [*R.A.M.*, xxiii, pp. 39, 314], but which the authors prefer to term 'leaf scorch'. Brown markings become superimposed on the normal autumn yellowing of the leaves, though the crop is little affected. Sometimes, however, scorching appears on maincrop potatoes in July, about a fortnight after flowering, or as soon as the plants have made their maximum growth of haulm, and may become exceedingly severe by mid-August. The leaflets, often hard and bluish-green at first, turn yellow towards the tips, they are marked both on the yellow and the green parts by brown spots and patches between the veins, and the edges are scorched. Whole leaves dry up, the leaf stalks double over, and the main stems collapse. The condition is usually more severe in the centres of fields, is more prevalent on dry or sandy soils than on good loam with sufficient organic

matter, and tends to be more severe in semi-drought than when there is plenty of rain, though it is common in wet seasons. Early crops show more leaf scorch in mid-August than later ones. Arran Banner appears to be more affected than Majestic.

Leaf scorch tends to be most severe on soils of high or average pH and high or normal lime content with high phosphate, and on crops of average to moderately good growth. A top-dressing to these soils of extra muriate of potash hoed in before earthing-up strikingly reduced leaf scorch and gave an increase in yield of 0·6 to 6 tons per acre. Spectrographic analyses of leaves showed that as the potash declined the calcium and magnesium contents increased, and vice versa. At the time when leaf scorch occurs, the amount of potash in the leaves dwindles and that of calcium and magnesium rises. It may be that leaf scorch is due at least as much to a high lime as to a low potash content and that the amount of leaf scorch depends on the calcium plus magnesium to potash ratio in the leaves.

Ordinary Bordeaux mixture often delays the onset of the condition. As the primary cause of the trouble often seems to be excess nitrogen, phosphate, or lime, rather than deficient potash, it may sometimes be better policy to avoid such excesses than to correct them with extra potash.

SMALL (T.). **Further studies on the effect of disinfecting and bruising seed Potatoes on the incidence of dry rot (Fusarium caeruleum (Lib.) Sacc.).**—*Ann. appl. Biol.*, xxxiii, 2, pp. 211–219, 1946.

Continuing his studies on dry rot (*Fusarium caeruleum*) [*R.A.M.*, xxv, p. 315], of potato, the author describes experiments, carried out at Manchester University Field Station, Warburton, Cheshire, in which tubers of the susceptible varieties, Ninetyfold and Doon Star, taken from seed crops grown in contaminated soil, were disinfected in their boxes immediately before being clamped after lifting, with a 0·5 per cent. solution of aretan, in which they were immersed, respectively, for one and three minutes. In some of the tests, the natural contamination of the soil adhering to the tubers was reinforced by spraying each tuber with a spore suspension of the fungus.

Seed tubers which had not been deliberately bruised on lifting, whether disinfected or not, were practically sound after three and six months' storage in clamps, except in one instance. On being taken from the clamps, tubers not disinfected prior to clamping remained sound provided they were carefully handled and stored for a further period in seed boxes, but moderate or severe loss was sustained according to the severity of bruising on removal. Those disinfected before clamping showed similar results, except that they remained sound even when slightly bruised on removal from the clamps.

Severe infection by *F. caeruleum* developed during storage in tubers not dipped before clamping and deliberately bruised after lifting in July or on reclamping in October. Incidence of infection was not affected by the position of the tubers within the clamp. Losses were only slight in tubers not dipped on lifting and clamping in July, but dipped after light bruising on removal from the clamps in October; they were heavy on those severely bruised before dipping in October. Tubers not dipped on lifting and clamping but which, after three or six months' storage in clamps, were slightly bruised and then dipped and severely bruised again two days later, suffered considerable losses but far less than in those not dipped. Tubers dipped on lifting immediately before clamping, if slightly bruised before re-dipping on removal from the clamps in October, remained almost sound, but those severely bruised just before the second dipping showed a loss of 12 per cent. These results were obtained with tubers taken from healthy clamps. Apparently healthy tubers, even if taken carefully from clamps contaminated with *F. caeruleum*, became severely diseased when re-stored in seed boxes.

JODON (N. E.) & CHILTON (S. J. P.). **Some characters inherited independently of reaction to physiologic races of Cercospora oryzae in Rice.**—*J. Amer. Soc. Agron.*, xxxviii, 10, pp. 864–872, 1946.

In further studies at the Louisiana Agricultural Experiment Station on the inheritance of reaction to *Cercospora oryzae* in rice [*R.A.M.*, xxiii, p. 499], the authors found no linkage in the F_2 progeny of 17 crosses between this character and a number of morphological attributes, such as plant and straw colour, endosperm consistency, and hull and leaf pubescence.

KHANNA (K. L.) & RAMNATHAN (K. R.). **A note on the occurrence of smut in Saccharum munja Munj Grass.**—*Curr. Sci.*, xv, 9, pp. 253–254, 2 figs., 1946.

A clump of *Saccharum munja* from Biknathoree, in the Terrai foothills, transplanted and grown at the Sugar-cane Research Station, Pusa, Bihar, India, produced numerous arrows, all attacked by a smut which was identified by B. B. Mundkur as *Sphacelotheca schweinfurthiana* (Thüm.) Sacc. This is believed to be the first record of a species of *Sphacelotheca* on *Saccharum*, though a member of the related genus *Sorosporium* [*S. indicum*] was reported by Mundkur on *Saccharum munja* in 1942 [*R.A.M.*, xxi, p. 305]. The diseased arrows were stunted and blackish but did not form the characteristic 'whips' of sugar-cane smut (*Ustilago scitaminea*) [ibid., xxv, p. 577]. All the florets were involved, and each contained masses of blackish spores replacing their essential organs. The infected shoots were abnormally precocious, some of them arrowing as early as May instead of at the normal time in November, a tendency already described by Rafay and Padmandabhan in connexion with sugar-cane smut [ibid., xx, p. 596] and recently observed on Co. 513 by the senior author of the present paper.

MOESZ (G. v.). **Fungi Hungariae. III. Ascomycetes. Pars 1. IV. Basidiomycetes. Pars 1. Uredineae.**—*Ann. hist.-nat. Mus. hung.*, Pars bot., xxxi, pp. 1–61, 1939; xxxiii, pp. 127–200, 1940; xxxiv, pp. 72–158, 1941; xxxv, pp. 73–87, 1942. [Hungarian and German. Received September, 1946.]

These further instalments of the author's critical studies on the mycoflora of Hungary [cf. *R.A.M.*, xviii, p. 139] comprise annotations on some 120 Ascomycetes [cf. ibid., xiii, p. 127] and 400 Uredineae on over 300 and 777 hosts, respectively. Bibliographies are appended to both sections, the entries relating to the Ascomycetes numbering 62 and those concerning the Uredineae 94.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xx, 7–8, pp. 71M–73M, 1946.

BELGIUM. By a Decree dated 11th March, 1946, all elms showing evident infection by *Graphium* [*Ceratostomella*] *ulmi* must be reported by land-owners or their agents to the forest inspector of the province before 1st July of each year. The affected trees must be felled within a period established by the forest inspector. This Decree replaces that of 21st August, 1942.

By Decree of the same date, all poplars evidently attacked by 'poplar canker' [*R.A.M.*, xiv, p. 478] must be similarly reported and felled.

FRENCH MOROCCO. By a Decree dated 20th November, 1945, the Decree of 10th September, 1936 [cf. ibid., xvi, p. 144] relative to the sanitary policy governing the importation of vegetables is supplemented by an Article, according to which consignments of potatoes, tomatoes, or eggplants must be certified in the country of origin as free from *Synchytrium endobioticum*, and the potato viruses: spindle tuber, unmottled curly dwarf [? a strain of spindle tuber], witches' broom, Canada streak [potato aucuba mosaic: ibid., xix, p. 162], and calico [caused by a strain of lucerne mosaic virus].